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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying

~~knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.~~

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Acknowledgments

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Dr. Tom Burnham, State Superintendent
Mr. William Harold Jones, Chair
Mr. Charles McClelland, Vice Chair
Ms. Kami Bumgarner
Mr. Howell "Hal" N. Gage
Dr. O. Wayne Gann
Mr. Claude Hartley
Ms. Martha "Jackie" Murphy
Ms. Rosetta Richards
Dr. Sue Matheson

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Finally, standards in the *Diesel Service Technician Curriculum Framework and Supporting Materials* are based on the following:

Industry Standards

National Automotive Technicians Education Foundation (NATEF) was founded in 1983 as an independent, nonprofit organization with a single mission: to evaluate technician training programs against standards developed by the transportation industry and recommend qualifying programs for certification (accreditation) by ASE, the National Institute for Automotive Service Excellence. For more information, visit http://www.natef.org/. Reprinted with permission.

Applied Academic Credit Benchmarks
Mississippi Department of Education 2007 Mississippi Mathematics Framework Revised

21st Century Skills and Information and Communication Technologies Literacy Standards
In defining 21st century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and Information and Communication Technology (ICT) literacy.

National Educational Technology Standards for Students
Reprinted with permission from *National Educational Technology Standards for Students: Connecting Curriculum and Technology*, Copyright © 2007, ISTE (International Society for Technology in Education), 800.336.5191 (U.S. and Canada) or 541.302.3777 (International), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute an endorsement by ISTE.

ACT College Readiness Standards

The College Readiness Standards are sets of statements intended to help students understand what is expected of them in preparation for the ACT. These standards are integrated into teaching and assessment strategies throughout the curriculum framework.

~~Preface~~

~~Secondary vocational–technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.~~

~~The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).~~

Using This Document

Unit Number and Title

Suggested Time on Task
An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75–80% of the time in the course.

Competencies and Suggested Objectives
A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Suggested Teaching Strategies
This section of each unit indicates research-based strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies that reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.

Suggested Assessment Strategies
This section indicates research-based strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

Integrated Academic Topics, 21st Century Skills and Information and Communication Technology Literacy Standards, ACT College Readiness Standards, and Technology Standards for Students
This section identifies related academic topics as required in the Subject Area Testing Program (SATP) in Algebra I, Biology I, English II, and U.S. History from 1877, which are integrated into the content of the unit. Research-based teaching strategies also incorporate ACT College Readiness standards. This section also identifies the 21st Century Skills and Information and Communication Technology Literacy skills. In addition, national technology standards for students associated with the competencies and suggested objectives for the unit are also identified.

References
A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested, and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Diesel Service Technician Executive Summary

Pathway Description

Diesel Service Technician is a pathway for students in the Transportation career cluster. This pathway is designed for students who wish to diagnose and repair the systems and components related to diesel engines. The pathway emphasizes the techniques and tools used in servicing diesel systems and components. Both theoretical learning and activity-based learning are provided for students who wish to develop and enhance their competencies and skills. The courses focus on the basic areas of diesel engine components, electrical and electronic systems, and hydraulics. Exposure to state-of-the-art equipment is given through advice by experts from industry. The comprehensive project component provides practical experience toward developing a portfolio of work.

The pathway is aligned with the NATEF 2007 Medium/Heavy Truck program standards, which were retrieved August 1, 2009, from http://www.natef.org.

Industry Certification

The Diesel Service Technician pathway was written to incorporate the **National Automotive Technicians Education Foundation (NATEF)** learning objectives, content, and hours. Any student who successfully completes this pathway will be eligible to apply to obtain the ASE exams. ASE requires 2 years of employment before certificates are issued. Students receive 1 year of credit for completion of the secondary program. Students who take certifications before the 2-year requirement is met will be granted certifications after they complete 1 year of diesel service employment. NATEF is a national certification recognized throughout the transportation service industry. Each district should implement a maximum student number due to the size of each lab.

Assessment

Students will be assessed using the Diesel Service Technician MS-CPAS2 test. The MS-CPAS2 blueprint can be found at http://info.rcu.msstate.edu/services/curriculum.asp. If there are questions regarding assessment of this program, please contact the transportation instructional design specialists at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be able to experience success in the Diesel Service Technician program, the following student prerequisites are in place:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)
3. Instructor Approval and TABE Reading Score (eighth grade or higher)

or

1. TABE Reading Score (eighth grade or higher)
2. Instructor Approval

or

1. Instructor Approval

Proposed Applied Academic Credit

Applied Mathematics content from the curriculum was aligned to the 2007 Mississippi Mathematics Framework Revised Academic Benchmarks. It is proposed that upon the completion of this program, students will earn one Applied Mathematics Credit that can be used for graduation requirements.

The applied academic credit has ***not*** been approved by the Mississippi Commission on School Accreditation or by the State Board of Education. If there are questions regarding applied academic credit, please contact the Coordinator of Workforce Education at the Research and Curriculum Unit at 662.325.2510.

Licensure Requirements

A 968 educator license is required to teach the Diesel Service Technician pathway. The requirements for the 968 licensure endorsement are listed below:

1. Applicant must have earned a 2-year college degree (associate degree) or higher from an accredited institution of higher education.
2. Applicant must have 2 years of documented diesel service experience.
3. Applicant must enroll immediately in the Vocational Instructor Preparation (VIP) or the Redesign Education Program (REP).
4. Applicant must complete the individualized Professional Development Plan (PDP) requirements of the VIP or REP prior to the expiration date of the 3-year vocational license.
5. Applicant must hold ASE certificates in Medium Heavy Duty Truck (test Diesel T2), Electrical/Electronics (Test T6), and Preventative Maintenance (Test T8).
6. Applicant must successfully complete an approved computer literacy certification exam.
7. Applicant must successfully complete a certification for an online learning workshop, module, or course that is approved by the Mississippi Department of Education.
8. Applicant must successfully complete a Diesel Service Technician certification workshop, module, or course that is approved by the Mississippi Department of Education.

Professional Learning

The professional learning itinerary for the middle school or individual pathways can be found at http://redesign.rcu.msstate.edu. If you have specific questions about the content of each training session provided, please contact the Research and Curriculum Unit at 662.325.2510, and ask for the Professional Learning Specialist.

Course Outlines

This curriculum framework allows multiple options for local school districts to implement based on the local needs of industry and students.

Option 1

This Diesel Service Technician Pathway option emphasizes industry-based content with time being allocated between lecture and lab activities. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF) learning objectives and content.

The Diesel Service Technician Pathway (four Carnegie units total) is a program that will prepare students for the diesel service industry. The content is divided into four one-credit courses. These courses are to be taken sequentially. Safety is an integral part of every course and activity. A student must complete all four courses to be a completer and to receive the one mathematics credit.

- Safety will be reinforced and tested at the beginning of each year and throughout the content.
- Students are not to enroll into multiple courses at the same time.
- Courses cannot be taken out of the order unless the instructor approves. Foundation knowledge in each course must be mastered to move to the next unit.
- Students must complete diesel courses with a score of 80/C or higher in class work to advance to the next level.

Course Description: Fundamentals of Diesel Systems and Components (Course Code: 997202)

Fundamentals of Diesel Systems and Components contains information on safety, tool identification and use, employee information, estimating, service specification and service information, measurement, and personal and business finance.

Course Description: Diesel Electrical/Electronic Systems (Course Code: 997203)

The Electrical/Electronic Systems course contains electrical/electronic system theory, battery systems, starting systems, charging systems, concepts of gauges, warning devices, driver information systems, horn system, wiper/washer system, and accessories system diagnostic repair.

Course Description: Diesel Engine Performance (Course Code: 997204)

The Diesel Engine Performance course contains information on safety, employability skills, advanced diesel service, diesel engine components and theory of operation, concepts of computerized engine control systems, and ignition systems.

Course Description: Diesel Auxiliary Components and Systems (Course Code: 997205)

The Auxiliary Components and Systems course contains information and skills relating to hydraulics, Introductory Truck Brake Systems, Introductory Agriculture/Construction Power Train and Components, and Introductory Welding and Cutting.

Fundamentals of Diesel Systems and Components (One Carnegie Unit) - Course Code: 997202

Unit		Title	Hours
1		Fundamentals of Diesel Systems and Components	25
2		Diesel Systems, Theories, and Components	115
			140

Diesel Electrical/Electronic Systems (One Carnegie Unit) - Course Code: 997203

Unit		Title	Hours
3		Electrical/Electronic Systems	140
			140

Diesel Engine Performance (One Carnegie Unit) - Course Code: 997204

Unit		Title	Hours
4		Preventive Maintenance and Inspection	70
5		Advanced Diesel Engine Performance	70
			140

Diesel Auxiliary Components and Systems (One Carnegie Unit) - Course Code: 997205

Unit		Title	Hours
6		Auxiliary Components	
		• Hydraulic Systems, Theories, and Components	70
		• Introductory Truck Brake Systems and S/S Components	15
		• Introductory Agriculture /Construction Power Train and Components	15
		• Introductory Welding and Cutting	40
			140

Option 2

This Diesel Service Technician Pathway option emphasizes industry-based content with time being allocated between lecture and lab activities. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF) learning objectives and content.

The content is divided into two courses. Safety is an integral part of every course and activity. A student must complete both courses to be a completer and to receive the one mathematics credit.

Course Description: Diesel Service Technician I (Course Code: 997200) Fundamentals of Diesel Systems and Components contains information on safety, tool identification and use, employee information, estimating, service specification and service information, measurement, and personal and business finance. It also contains Electrical/Electronic Systems content: electrical/electronic system theory, battery systems, starting systems, charging systems, concepts of gauges, warning devices, driver information systems, horn system, wiper/washer system, and accessories system diagnostic repair.

Course Description: Diesel Service Technician II (Course Code: 997201) The Diesel Engine Performance course contains information on safety, employability skills, advanced diesel service, diesel engine components and theory of operation, concepts of computerized engine control systems, and ignition systems. It also contains Auxiliary Components and Systems content: information and skills relating to hydraulics, Introductory Truck Brake Systems, Introductory Agriculture/Construction Power Train and Components, and Introductory Welding and Cutting.

Diesel Service Technician I (Two Carnegie Units) - Course Code: 997200

Unit		Title	Hours
1		Fundamentals of Diesel Systems and Components	25
2		Diesel Systems, Theories, and Components	115
3		Electrical/Electronic Systems	140
			280

Diesel Service Technician II (Two Carnegie Units) - Course Code: 997201

Unit		Title	Hours
4		Preventive Maintenance and Inspection	70
5		Advanced Diesel Engine Performance	70
6		Auxiliary Components	140
			280

- ~~Scheduling and operating more than one course in the same classroom/laboratory with the same teacher is not allowed.~~
- ~~Students must complete the first year with a score of 80/C or higher in class work to advance to the next level.~~

Diesel Service Technician Research Synopsis

Diesel Service Technician Research

Diesel engines are the backbone of the American Infrastructure (Houston, 2008). Diesel engines are installed in all types of equipment that are vital to the economy of Mississippi and around the world. Some examples of these are pavers and rollers that are used to pave the roads that connect factories to distributors to consumers; semi trucks that transport goods, cargo, and grain to local markets and ports; agriculture tractors and combines that produce the grain the world's population consumes; construction dozers and excavators that build the infrastructure; forestry skidders and log loaders of trees for furniture, lumber, and paper products; mining dump trucks to shovels for coal for electricity; railroad locomotives that transport materials and supplies across nations; and cargo ships and airplanes for transportation around the world. There are also numerous types of applications that use diesel engines: generators, boats, lawn mowers, and so forth. These pieces of equipment are used to support the large equipment or are used in recreation or emergency situations. Diesel engines are an integral part of everyday life and pertinent to the global society. To keep these machines operating requires a highly skilled technician. The diesel service technician services and repairs all components to include the diesel engine, electrical/electronic systems, hydraulics, steering/suspensions, and brakes.

Industry Certifications

National Institute for Automotive Service Excellence (ASE)

ASE was created in 1972 in response to customers wanting to be able to identify competent or incompetent technicians. The organization is independent and nonprofit. The exam questions are written by experts that represent a cross-section of the automotive service industry nationally. These professions include technicians, manufacturers and aftermarket training representatives, customer service professionals, and automotive educators. ASE test content parallels actual collision work situations, and content is based on National Automotive Technicians Education Foundation (NATEF) standards. Question developers spend a considerable amount of time developing each question. Certification requires an individual to pass an exam and have 2 years of relevant hands-on experience. These certifications serve as the technician's proof of competence and effectiveness. As of 2008, there are approximately 420,000 ASE-certified professionals around the United States. These occupations are collision repair/refinish technicians (34,540), master collision repair/refinish technicians (7,262), and collision damage estimators (10,650); (ASE, 2008).

Employment

According to the Bureau of Labor Statistics (BLS) in 2006, there approximately 652,000 technicians that service/repair diesel engines and related systems were employed in the United States. The need for technicians is growing with each passing year.

Industry Job Data – Employment Projections 2006 to 2016 for Mississippi

Note: Compiled by Mississippi Department of Employment Security and Labor Market Information Department

Occupation	2006 Employment	2016 Projected Employment	Change, 2006–2016	Median Hourly Earnings
Bus and truck mechanics and diesel engine specialists	275,000	306,000	32,000 or 11 %	$18.11
Heavy vehicle and mobile equipment service technicians and mechanics	188,000	206,000	18,000 or 10 %	$19.44
Farm equipment mechanics	31,000	31,000	400 or 1 %	$14.16
Mobile heavy equipment mechanics, except engines	131,000	147,000	16,000 or 12 %	$19.44
Rail car repairers	27,000	28,000	1,300 or 5%	$20.82

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the introductory chapter on Occupational Information Included in the Handbook.

Source: U.S. Department of Labor, Bureau of Labor Statistics. (2008). *Occupational outlook handbook, 2008–2009 edition*. Retrieved May 7, 2008, from http://www.bls.gov/soc/home.htm

~~Kilcare, senior editor for Fleet Owner, states, "The growing shortage of technicians serving the trucking industry is not a problem that's going from bad to worse—it's a problem that's going from bad to right off the cliff." Kilcare concluded there are a number of contributing factors: the baby boomers that are retiring and those that are going to retire, along with the lack of younger generations not choosing diesel technician as a career choice. White, vice president of marketing and communications for the Automotive Aftermarket Industry Association, concluded that 78 million baby boomers will begin to retire in 2008 and will be replaced with Generation X. Generation X is comprised of only 45 million workers. White concluded that there are not enough people to fill the jobs left vacant by retirees. The impact in the maintenance profession is going to be major. It will also affect the distributors and store personnel.~~

Mississippi Industry Survey Results

- On average 3,872 diesel technicians are continually employed by survey respondents.
- The average age of the survey respondents was 37 years.
- All companies provide employees with training after being employed using face-to-face, hands-on, and online instruction.
- Training is continual throughout a technician's career. Training is usually done several times throughout a year, every year. Training is done to provide technicians the latest information and access concerning products and procedures.
- All employees will attend training regardless of years of experience, education, or certification.
- Internships, co-ops, and work-based programs need to be developed between secondary programs and local businesses. These programs would provide valuable experience for students. Time could be earned in the afternoons, weekends, and/or summers.

Respondents placed emphasis on the following areas:

Academic	Technology	Technical Content	Workplace Skills
• Reading • Writing • Math • Physical science or physics	• Keyboarding • Internet skills • Electronic communication skills (e-mail) • Diagnostic system software	• Safety and tool usage • Diesel engine theory, systems, and diagnostics • Electrical/electronic theory, systems, and diagnostics • Hydraulic and electric over hydraulic theory, systems, and diagnostics • Preventative maintenance schedules and procedures	• Basic mechanical skills and a basic understanding of machinery operation • Troubleshooting skills • Failure analysis • Work ethics • Customer relations • Interpersonal skills

Mississippi Instructor (Diesel and Vehicle/Mobile Equipment) Survey Results

- Currently in the State of Mississippi, there are two secondary diesel programs and seven vehicle/mobile equipment programs.
- The average number of years of industry experience was 16.
- The average number of years of teaching experience was 12.

Respondents placed emphasis on the following areas for improvement or needs:

Equipment	Technology	Technical Content	Workplace Skills
• Up-to-date engines for diagnostics; tear down and rebuild engines • DVOM • Hydraulic trainers • Electronic trainers • Brake lather • Specialty diesel tools	• Computers for students • Laptop for instructor • Internet • Diagnostic System Software • Simulators • Electronic training software	• Current equipment used in field • Training on current industry software • Training on current industry equipment	• Basic mechanical skills • Communication skills

Curriculum Content

According to the BLS, employers prefer to hire high school graduates. To be prepared academically for these jobs, students need to enroll in academic courses, such as English, mathematics, and physics. For students to have a foundation in industry skills and knowledge, students should enroll in a secondary diesel technology program. The content for the secondary Diesel Service Technician program is based on the National Automotive Technician Education Foundation (NATEF) task list. NATEF and the Vocational–Technical Education Consortium of States (V-TECS) identified related academic skills that are embedded into the Medium/Heavy Truck Technician task list. These academic skills are embedded in the tasks that technicians perform. Technicians perform a wide variety of tasks: maintaining diesel engines and hydraulic systems, diagnosis and repairing electrical/electronic systems, transmission servicing/repair, suspension/steering components, and brake systems/components.

The Automotive Service Excellence (ASE) is a recognized industry certification for diesel technicians.

Below is the content from the NATEF - Medium/Heavy Duty Truck Technician task list for diesel, electrical/electronic systems, preventative maintenance, and inspection and hydraulics. ASE/NATEF secondary program certification will not be possible because of the depth of material and the vast amount of hours required. The *Redesign* Diesel Service Technician curriculum content will be based on specific ASE/NATEF content derived from a variety of sources: industry responses, secondary and postsecondary instructor responses, and diesel industry research.

Based on the industry and instructor responses and diesel industry research, the *Redesign* Diesel Service Technician Content chart contains curriculum content for the secondary career and technical programs in Mississippi. The diversity of industry content gives students exposure to introductory knowledge and skills. The depth of content enables students to master skills.

Redesign Diesel Service Technician Content

Diesel	Electrical/Electronics	Preventive Maintenance and Inspection	Hydraulics
• General engine diagnosis and repair • Cylinder head and valve train • Engine block • Lubrication systems • Cooling system • Air induction and exhaust systems • Fuel system • Electronic fuel management system	• General electrical system diagnosis • Battery diagnosis and service • Starting system diagnosis and repair • Charging system diagnosis and repair • Lighting systems diagnosis and repair • Gauges, warning devices, and driver information systems • Related electrical systems	• Engine System • Fuel system • Air induction and exhaust system • Cooling system • Lubrication system • Cab and hood • Instruments and controls • Safety equipment • Hardware heating, ventilation, and air conditioning (HVAC) • Electrical/Electronics • Battery and starting systems • Charging system • Lighting system • Frame and chassis • Tires/Wheels or tracks • General suspension and steering systems/component diagnosis	• General system operation • Pumps • Filtration/ Reservoirs (tanks) • Hoses, fittings, and connections • Control valves • Actuators

Students that complete the high school program will be ready for entry-level positions in the workforce. They can also elect to enroll in a community college. The community college diesel programs in Mississippi are currently aligned to ASE/NATEF standards. These programs provide a natural progression from basic content to the complex. Students that elect to enroll in a university program will focus on engineering, business, or marketing. Students choosing to enroll at community colleges and universities should review admission requirements.

Certifications and training were not indicated as being requirements for acquiring a job. Training and certification may be encouraged or required depending on the particular business environment. All respondents indicated that new employees serve as an apprentice to a senior technician. During this time, the senior technician assigns simple tasks that need to be completed. As skill level, experience, and knowledge increase, more complex tasks are assigned.

~~One factor for students not choosing diesel mechanics as a career path is the negative image or perception of the field. Most people that are not familiar with the industry picture the job as dirty, filthy, and low paying. Uffer (Kilcarr, 2001), president of New Jersey-based dealership Truck Tech and a board member of the National Institute for Automotive Service Excellence (ASE), stated the impression of diesel mechanics is an unrewarding field. That is why a complete program makeover is needed for the diesel mechanics programs. Shops and classrooms need to be painted, cleaned, and well organized. This image is a direct reflection of the industry. Industry facilities are clean and well organized so the work process flows seamlessly. Equipment and training aids should reflect models currently in production. If students are not training on the latest, they are training in the past.~~

~~Diesel engines and the systems that accompany them appear to be a part of this industry for the near and distant future. Students who choose to be technicians will have a variety of options. They can either choose to further their education at a community college or university or become an entry-level technician. Those who attend community college will receive in-depth training on power trains, air brakes, and other systems and components relative to the type of vehicle. The university route allows students to choose among engineering, businesses, and management/marketing majors. Options for those who wish to become entry-level technicians include the medium heavy-duty truck field or the agricultural/construction field. No matter which route an individual selects, students must prepare for an exciting, competitive career field that is ever-evolving.~~

~~Blueprint~~

~~You will find the blueprint that corresponds to this document at http://redesign.rcu.msstate.edu/curriculum/.~~

~~Diesel Service~~

Unit 1: Fundamentals of Diesel Systems and Components

Competency 1: Introduce, describe, and distinguish local program and vocational/career–technical center policies and procedures. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Safety is an integral part of daily life.
2. Rules and regulations are essential to a safe work environment.

Suggested Essential Questions

1. What would happen if there were no rules and regulations?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Describe local program and vocational/career–technical center policies and procedures including dress code, attendance, academic requirements, discipline, and the school technology acceptable use policy and transportation regulations. (DOK 1)	a. Divide students into two groups. Assign one of the following scenarios to each group. Have groups present a role-play for their assigned scenarios. • Imagine a school or business without rules. What would a normal day be like? What would a normal class be like? How productive would your day be? • Imagine a school or business that has created a rule and a procedure for everything. What would a normal day be like? What would a normal class be like? How productive would your day be? CS1 CS2 CS4, T1 T2 T3 T4, E1 E2 E3 M1 R1 R2 W1 Review all of the local program policies; including dress code, attendance, academic requirements, discipline, and the technology acceptable use policy using the presentation station. Post all of these documents on the classroom bulletin board.	a. After the role-play, students will ask questions and discuss the answers. Evaluate the role-play using the **Role-Play or Skit Rubric for Shop/Lab Safety Activity**.
b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations. (DOK 2)	b. Ask students, "What skills or behavioral characteristics does this school/classroom expect from you? What skills or behavioral characteristics do employers and/or industries expect from you? How are they different? How are they the same?" Have students visit or interview diesel service industry members to learn about industry policies, procedures, and expectations. Have students visit http://www.teachnology.com/web_tools/graphic_org/venn_diagrams/ and create a Venn diagram that compares and contrasts local program policies, procedures, and expectations to industry policies, procedures, and expectations. CS1 CS2 CS4 CS5, T1 T2 T4, E1 E2 E3 E4 E5 E6 R1 R2 R3 S1 W1 W2 W3	b. Give an electronic test on local school rules and regulations using the Blackboard class Web site. Have students complete a form verifying that they have received instructions on local school rules and policies. Parents should also sign to acknowledge rules and policies. This should be kept in a student folder.

Competency 2: Introduce, describe, and express employment opportunities and responsibilities of the diesel service industry. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings **Suggested Essential Questions**

1. Society depends on diesel services and diesel service technicians. Employers are looking for specific skills in employees.	1. What would the nation and world be like without diesel service technicians? 2. What skills do employers look for in diesel services?	
Suggested Performance Indicators	**Suggested Teaching Strategies**	**Suggested Assessment Strategies**
a. Introduce concepts associated with the diesel service industry; describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. (DOK 1) SMT1	a. As a group activity, have students interview three industry members from the diesel service sector or professionals related to the course and determine employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. Divide the students into groups, and have them develop a multimedia presentation regarding the interview information and present their findings to the class. Allow students to discuss their findings and expectations for the course. Have students record findings in their electronic journals using a Blog or a word processing program. Have students use the writing process to summarize their information. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 , E1 E2 E3 E4 R1 R2 R3 S1 S2 W1 W2	a. Evaluate the journal activity using the **Journal Rubric**.
b. Describe basic employee responsibilities and how to communicate effectively in on-the-job situations. Identify and apply the practices that affect employer and employee decision making as it relates to identifying and applying appropriate algebraic formulas to personal finance situations, linear programming to business decisions, and algebraic formulas to personal and business investments. (DOK 2) SMT2	b. Have students use the Internet and other classroom resources to research employment opportunities, educational opportunities, and working conditions in the diesel service industry. Have students role-play a given situation. Have students choose to be a technician, a manager, a customer, or a parts specialist. Have students interact with each other in a variety of situations related to the workplace (i.e., practices that affect employer and employee decision making as it relates to identifying and applying appropriate algebraic formulas to personal finance situations, linear programming to business decisions, and algebraic formulas to personal and business investments). After each skit, the class will discuss the situations, the pros and cons of each, and how each will relate to a successful business. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4	b. Evaluate the skit using the **Role-Play or Skit Rubric for Employment Skills.**
c. Discuss the history of the diesel service industry to include materials, terminology, and techniques. (DOK 2)	c. Allow students to use the Internet to search for four to five articles regarding the history of the diesel service industry. After a classroom discussion, have students record facts in their electronic journals. Have students record findings to the given topic(s) listed below: • Early diesel engines	c. Evaluate the electronic journal activity using the **Journal Rubric**.

	• The Otto Engine • Development of the current diesel engine • Application of diesel engines CS1, T1 T2 T3 T4, E1 E2 E3 M8 R1 R2 R5 S1 W1 W2	
d. Research and report the computerized systems used by technicians in the diesel service industry. (DOK 3) PRA1, PRA4	d. Allow students to use trade journals or catalogs to research computerized systems used by technicians in the diesel service industry. Have students contact the vendor to obtain information regarding the product. Have students present the information to the class. CS1 CS2, T1 T2 T3 , E1 E2 E3 E4 E5 E6 M1 M2 M3 M7 M8 R4 R5 S1 S2 W1 W2 W5	d. Evaluate the presentation using the **Presentation Assessment Rubric**.

Competency 3: Investigate and replicate leadership skills and personal development. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings	**Suggested Essential Questions**
1. Leadership and team-building skills are needed to be successful in a career. 2. Student involvement in SkillsUSA develops and enhances the skills employers are looking for. 3. First impressions are key when seeking employment.	1. What leadership and team-building skills are necessary for success in any career? 2. What are some strategies you could use to make yourself more employable? 3. What attributes and/or documents contribute to an employer's first impression of you?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Demonstrate effective team-building and leadership skills. (DOK 1)	a. Use the SkillsUSA team-building CD to describe the purposes of the SkillsUSA organization and the activities and programs that support these purposes. Have students use the Internet to research the SkillsUSA Web site for more in-depth information. Have each student reflect on how the SkillsUSA organization will benefit him or her. Students' reflections will be shared through classroom discussion. CS1 CS2 CS3, T1 T2 T3 T4 T5 T6, E1 E2 R1 R2 S1 S2 W1 W2 W5 Divide students into teams. Assign team leaders and rotate throughout the year. As tasks are assigned, the team works together to complete the tasks. These tasks should be classroom or shop activities. Have students brainstorm different activities that they will be able to work together as a team to complete. These are listed on the poster board and will be checked as activities are completed. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5	a. Monitor the class for participation. Evaluate throughout the year using the **Team-Building and Participation Rubric**. Evaluate team-building activities using the **Teamwork Rubric**.
b. Model appropriate work ethics. (DOK 1)	b. Evaluate students on their practice of work ethics and values periodically through the activities and assignments made in the remainder of the course. CS1 CS4 CS5, T1 T2 T3 T4, E1 E2 E3 E4 E5 E6 R1 R2 R3 S1 W1 W2	b. Evaluate student work ethics and values periodically using the **Work Ethics and Values Rubric**.

c. Describe basic employee responsibilities. (DOK 1)	c. Give students sample job announcements that have employee responsibilities listed. Have students make a common list of responsibilities that all employers expect. List the common items on the board. Lead students in a classroom discussion about each responsibility. Have students pretend they are the manager of a collision shop. Have the managers discuss what responsibility on the common list they would eliminate. Ideally, the group will decide that they are all important and none can be eliminated. As an enrichment activity, have students model basic employee responsibilities in a skit. CS1 CS2 CS4 CS5	c. Monitor classroom discussion for content. Ensure that all students participate by asking, "What do you think about that comment?" Evaluate the skit using the **Role-Play for Employability Skills Rubric**.
d. Design a resume and letter of application, and complete a job application. (DOK 1)	d. Bring samples of good and bad resumes, letters of application, and completed job applications. Ask students to pretend they are the manager of a shop. Have the mangers discuss who they would hire and why. Have students work in small groups and then in large groups to create a list of "must do's" for resumes, letters of application, and job applications. Ask these questions to check for understanding: • What information is listed on a resume? • Why is it important to complete a job application? • When providing a reference, should you call the reference first? Have students do the following: Use technology to design a resume and letter of application. Peer review the resume and letter of application. Research job opportunities using newspaper, journals, and the Internet. Download the job application and complete. Peer review the job application. CS1 CS4 CS5, T1 T2 T3 T4 T6, E1 E2 E3 E4 E5 E6 R1 R2	d. Evaluate the resume, letter of application, and completed job application using the **Resume Assessment Rubric**.
e. Demonstrate an understanding of the impact of consumer credit (advantages and disadvantages of installment loans, applying algebraic formulas to consumer credit). (DOK 2) SMT3	e. Each student will visit a local lending institution and obtain and complete a loan application. Students will then research the advantages and disadvantages of installation loans. Using the Internet, students will use loan calculators to compute loan information. Each student will create an electronic presentation of the information. CS1 CS4 CS5, T1 T2 T3 T4 E1 E2 E3 E5 M1 M7	e. Evaluate the letter of application using the **Letter of Application Rubric**. Evaluate the job application by peer review.
f. Design, collect, and apply information for planning a trip. (DOK 2) SMT4	f. Divide the students into small groups. Each group will make all decisions concerning a trip. The trip can be for a variety of reasons: to attend the collision technician annual meeting, to attend I-Car or ASE certification classes, or other topics that are related to the collision repair industry. Ensure that students complete the following when planning: • Investigate and evaluate modes of	f. Evaluate the presentation using the **Presentation Assessment Rubric**. Evaluate the presentation using

	transportation. • Create a travel budget. • Make travel plans based upon airline schedules. • Apply map-reading skills. • Apply appropriate formulas used for planning a trip. Have students research modes of transportation, creating a travel budget, travel plans by air, map-reading skills, and formulas for planning a trip. Have students present their information to the class. Each group should have to justify and explain its actions to its peers. CS1 CS2 CS5, T1 T2 T3 T4 T6, E1 E2 E3 M1 M7 R1 R2 R5 W1	the **Group Presentation Assessment Rubric**. Evaluate the discussion using peer review. Monitor the class for appropriate questions and discussion topics

Competency 4: Model general safety rules for working in a shop/lab and an industry setting. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Safe use and proper choice of tools is important to completing a job in the diesel service industry.
2. Knowing proper safety procedures is essential in the instance of a workplace fire.

Suggested Essential Questions

1. Why are there safety rules and regulations?
2. What happens when you choose the improper tool for the job or use a tool in an incorrect manner?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Explain the importance of following all safety rules and policies (report all on-the-job injuries and accidents), evacuation policy, substance abuse policy, and procedures when working near pressurized or high temperature, and explain electrical hazards and the action to take when an electrical shock occurs when performing diesel service operations (personal protective equipment, procedures for lifting heavy objects, and MSDS). (DOK 3)	a. Show students videos demonstrating examples of accidents in the workplace (http://www.unitedstreaming.com). Pre-assess knowledge of safety by having each student write a summary of the safety violations present in the videos. Present the following terms to students: • Evacuation policy • Substance abuse policy • Procedures when working near pressurized or high temperatures • Electrical hazards • Electrical shock • Personal protective equipment • Procedures for lifting heavy objects • MSDS Divide students into groups based on learning styles, and assign each group a guideline for personal and laboratory safety (i.e., chemicals, fire, equipment, animals, and electrical) or general	a. Evaluate the role-play activity using the **Role-Play or Skit Rubric for Shop/Lab Safety Activity**. Required written tests will follow each section of guidelines for safety rules and procedures. When applicable, use the assessment tools found in the Blackboard Learning System. Monitor student participation, and grade the safety exam. The student must achieve 100% accuracy. Print and place in the student's file. Evaluate the MSDS activity using the

	laboratory conduct. Have each group role-play, create a multimedia presentation or a rap song, or write a story to discuss the proper and improper procedures related to the guideline. Divide students into groups. Each group will receive an MSDS. Have students research the assigned item and answer the questions on the **Interpret MSDS Rubric**. CS1 CS4 CS5, T4 T5 T6, E1 E2 E3 M1 M2 M7 R1 R2 R3 S1 W1 W4 W5	**Interpret MSDS Rubric**.
b. Explain the process by which fires start, fire prevention of various flammable liquids, the classes of fire, and the types of extinguishers. (DOK 1)	b. Invite the local fire department to lead a fire safety lesson. Have students use fire extinguishers properly. Have students locate all fire extinguishers in the school. Have students determine and select the proper fire extinguisher for different types of fires. CS4 CS5, T3 T4 T6, E1 E2 E3 M1 M2 M7 R1 R2 R5 S1 W1 W2 W4	b. Evaluate the guest speaker's presentation using the **Guest Speaker Evaluation Form**.
c. Identify and demonstrate the safe and proper use of common hand tools. (DOK 2)	c. Use classroom materials to discuss and demonstrate the proper use of common hand tools including wrenches, screwdrivers, pliers, and hammers; hand-operated power tools including and portable and stationary; and power equipment including hydraulic body jacks, floor jacks, hoists, hydraulic lifts, drill press, lifting equipment, cleaning equipment, along with other diesel service tools. Use the six-step process for teaching new terms to students: • Provide a description, explanation, and example of the term. • Ask students to restate the description, explanation, or example in their own words. • Ask students to construct a picture, symbol, or graphic representing the term. • Engage students periodically in activities that help them add to their knowledge. • Periodically ask students to discuss the terms with each other. • Involve students periodically in games that allow them to play with the new terms. Have each student choose a tool or piece of equipment. Have students research the item and give a presentation. CS2 T3 T4 E1 E2 E3 E4 E5 M7 R1 R2 R3 R4 R5 S1 W1 W2 W3	c. Administer a written exam to test students' knowledge of the proper use of common hand tools.

Competency 5: Interpret and apply service specifications and information. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Specialized information is required before servicing a vehicle.
2. Specifications and vehicle information are required to restore a vehicle to OEM specifications.

Suggested Essential Questions

1. What information should you know before you begin working on a vehicle?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Locate and interpret service specifications and information, using both print and computerized service information references and vehicle and major component identification numbers (VIN, certification, and calibration labels). (DOK 1)	a. Review the text, Internet, manuals, and handouts for locating and applying information. Have each student locate specific information using text, Internet, manuals, and handouts for an assigned vehicle at school. Have students record information in their electronic journals. Students will present findings to the class. Findings must address the following questions: • Why it is important to have the correct information on a vehicle before repairs begin? • Why is it important to be able to locate information on vehicles? CS1 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M7 R1 R2 R3 R4 R5 S1 W1 W2	a. Evaluate using the **Presentation Assessment Rubric**.
b. Interpret and apply information to a specific job on a specific vehicle. (DOK 3)	b. Using a job sheet for specifications, have students record the required information from their own vehicle or from a neighbor's. The **Job Sheet/Performance Rubric** will be given to each student and reviewed for understanding. CS1, T1 T2 E1 E2 E5 E6 M1 M7 M8 R1 R2 R3 R4 R5 S1 W1 W2 W5	b. Evaluate using the **Job Sheet/Performance Rubric**.

Competency 6: Demonstrate measurement practices used in the diesel service industry. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Measurement tools and equipment are used to check for tolerances.
2. Accurately measuring parts, surfaces, or shafts can determine the extent of damage or wear.

Suggested Essential Questions

1. Why should an item be measured?
2. Why can you not rely on visual inspections?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Measure the length of an object using a rule to the nearest 1/16 in. and 1 mm. (DOK 1) PRA1, PRA4	a. Give students the following scenario: the distance from your nose to the outside of your fingertips is about 1 m. Estimate the distance between you and three objects in the room. Have each member in the class make a data table and record his or her estimates. Have each student verify his or her estimation and compare it with the real measurement. Lead a class discussion using the following prompts: • Were the estimates reasonably close?	a. Evaluate measurement activities using the **Measurement Rubric**. Assess students as they measure given items and record the measurements on a job sheet.

	• Did one person consistently make accurate estimates? Explain the importance of proper measurement practices, display tools that are used for measurement, and demonstrate how to operate the instruments. Demonstrate how to measure a given item using a variety of measuring instruments. Have students work in groups to measure given items and record the answers on a job sheet. CS1 CS2 CS3 CS5, T1 E1 E2 M7 R1 R2 S1 W1 W2 W3	
b. Identify the different types of bolts (grade, diameter, length, and thread pitch), nuts, and washers, and describe their appropriate uses. (DOK 1) PRA1, PRA4	b. Using a variety of bolts, nuts, and washers, have students match the appropriate pieces into a complete unit. Then have students categorize each unit by grade, diameter, length, and thread pitch. Have students discuss the activity. CS4, T1 T2, E1 E2 M1 M7 R1 R2 R3 R4 R5 S1 W1 W2 W5	b. Evaluate the bolt, nut, and washer activity using peer review.

Competency 7: Manage personal and business finances to include aspects of employer–employee decision making and consumer credit. DOK1 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. It is important to effectively budget your money.
2. Filing income tax forms should be done by the dates (yearly or quarterly) required.
3. Business decisions should be made before the business transaction begins.
4. Investigate your employer's insurance benefits when beginning a new job.
5. Before opening a credit card account, an individual needs to completely understand the way credit card accounts operate.

Suggested Essential Questions

1. Why should you have a personal and/or business budget?
2. What happens if you do not file income tax returns?
3. What are the advantages and disadvantages of renting or buying a house or business?
4. What are the advantages and disadvantages of employers' providing health and/or life insurance?
5. What are the advantages and disadvantages of paying credit card balances every month?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Design, analyze, and develop business finance concepts and skills. (DOK 3) SMT1	a. Guest speakers: Invite guest speakers to discuss budgets, ownership, insurance, and credit cards. Divide students into groups. Have each group choose one of the topics to research (budgets, ownership, insurance, and credit cards). Have students present the material on their topics to the class. Have students divide into teams and debate the topics. CS1 CS2 CS3 CS4 CS5, T1 T3, E1 E2 E3 E4 E5 E6 M1 M7 R1 R2 R3 R4 R5 S1 W1 W2 W5 Ensure that student research and projects include the following: • Develop household and business budgets. • Use and apply basic accounting procedures to	a. Evaluate the guest speaker using the **Guest Speaker Evaluation Form**. Evaluate the journal activity using the **Presentation Assessment Rubric**. Evaluate the debate using the **Debate Rubric**.

~~maintain and balance a checkbook.~~

- ~~Identify the terminology and apply the process of filing personal income tax returns.~~
- ~~Identify and explain the components and processes involved in the purchase, operation, and maintenance of a personal vehicle.~~
- ~~Determine the advantages and disadvantages of housing alternatives.~~
- ~~Use information and data to make sound decisions regarding personal savings.~~
- ~~Identify life and health insurance terminology, and apply it to real-world situations.~~
- ~~Compute and compare various forms of earnings, and calculate gross pay, deductions, and net pay.~~
- ~~Compare and contrast the finances of credit cards.~~
- ~~Identify and explain the components and processes involved in the stock market, and apply them to real-world applications.~~

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.
PRA4 Understand measurable attributes of objects, and apply various formulas in problem-solving situations.

Survey of Mathematical Topics

SMT1 Compute, analyze, and develop a variety of skills necessary to manage personal and business finance to include aspects of employer–employee decision making and consumer credit.
SMT2 Identify and apply the practices that affect employer and employee decision making.
SMT3 Demonstrate an understanding of the impact of consumer credit.
SMT4 Collect and apply information for planning a trip.

21st Century Learning Standards

CS1 Flexibility and Adaptability
CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

National Education Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

ACT College Readiness Standards

E1 Topic Development in Terms of Purpose and Focus
E2 Organization, Unity, and Coherence
E3 Word Choice in Terms of Style, Tone, Clarity, and Economy
E4 Sentence Structure and Formation
E5 Conventions of Usage
E6 Conventions of Punctuation
M1 Basic Operations and Applications
M2 Probability, Statistics, and Data Analysis
M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement

~~M8 Functions~~
~~R1 Main Ideas and Author's Approach~~
~~R2 Supporting Details~~
~~R3 Sequential, Comparative, and Cause–Effect Relationships~~
~~R4 Meaning of Words~~
~~R5 Generalizations and Conclusions~~
~~S1 Interpretation of Data~~
~~S2 Scientific Investigation~~
~~S3 Evaluation of Models, Inferences, and Experimental Results~~
~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

Association of Diesel Specialists. (n.d.) *Nozzle chatter*. Retrieved October 13, 2009, from http://www.diesel.org/

Automotive Service Association. (n.d.). *AutoInc.* Retrieved September 4, 2009, from http://www.autoinc.org/

National Institute for Automotive Service Excellence. (n.d.). *ASE blue seal news tech news.* Retrieved September 4, 2006, from http://www.ase.com

Texts

Bennett, S., & Norman, I. (2006). *Heavy duty truck systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1-4018-7064-3 (Workbook-ISBN 1-4018-7065-1 and DVD 1-4018-7066-X available)

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinley Park, IL: Delmar Goodheart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

Peterson, J., & deKryer, W. (2006). *Math for the automotive trades*. Clifton Park, NY: Thomson Delmar Learning. ISBN 10: 1-4180-3101-1

Videos

Films Media Group. (1993). *Diesel cylinder head service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Films Media Group. (2005).Diesel engine teardown. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Diesel Power. (n.d.) Retrieved October 1, 2009, from http://www.dieselpowermag.com/

How stuff works. (n.d.). Retrieved October 12, 2009, from http://www.howstuffworks.com/

National Institute for Automotive Service Excellence. (n.d.). Retrieved September 12, 2009, from http://www.asecert.org/

~~Suggested Rubrics and Checklists~~

Name: _____

Date: _____

Period: _____

Debate Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Information	All information was accurate and clear.	Most information was accurate and clear.	Most information was accurate but not completely thorough or clear.	Information was inaccurate or needed clarification.	
Rebuttal	All counterarguments were accurate, relevant, and strong.	Most counter-arguments were accurate, relevant, and strong.	All counterarguments were accurate and relevant, but some were weak.	Counterarguments were not accurate or relevant.	
Organization	All arguments were logical and clearly followed a premise.	Most arguments were logical and clearly followed a premise.	Arguments were logical but did not always follow a premise.	Arguments were not logical and/or did not follow a premise.	
Understanding of the Topic	The individual/team clearly understood the topic fully and presented in a convincing manner.	The individual/team clearly understood the topic fully and presented with ease.	The individual/team understood the main points of the topic and presented those well.	The individual/team did not exhibit an adequate understanding of the topic.	
				Total Score	

Name: _____

Date: _____

Period: _____

Work Ethics and Values Rubric

Behavior/Skill	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1	Score
Punctuality (arrives on time)					
Preparation (completes pre-assignments and brings necessary materials)					
Respects other students/workers					
Listens to supervisor and follows directions					
Accepts responsibility for actions					
Demonstrates positive personality traits (kindness, trustworthiness, and honesty)					
Demonstrates productivity (patient, thorough, and hard working)					
Demonstrates a concern for others					
Remains on task and allows others to remain on task					
Takes initiative as appropriate					

Name: _____

Date: _____

Period: _____

Measurement Rubric

Object to Be Measured_____

Measuring Instrument _____

Record measurements below (length, depth, width, internal, external, etc.):

Rate the ability of the student to perform measurement tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Safety procedures	
Uses proper measuring instrument	
Understands how to measure	
Records proper measurements	

Comments:

Name: _____

Date: _____

Period: _____

Teamwork Rubric

	Exemplary 4 Points	**Accomplished 3 Points**	**Developing 2 Points**	**Score**
Sharing	Shared ideas with others	Occasionally shared ideas with others	Seldom shared ideas with others	
Listening	Always listened to peers	Occasionally listened to peers	Ignored ideas of peers	
Respecting	Interacted with, encouraged, and supported ideas of others	Occasionally encouraged and supported others	Seldom encouraged and supported others	
Participating	Shared task equally with group members	Did most of the task	Did very little of the task	
			Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric for Employment Skills

	Exemplary 4 Points	**Accomplished 3 Points**	**Developing 2 Points**	**Beginning 1 Point**	**Score**
Accuracy	All diesel service/business information was accurate.	Almost all diesel service /business information was accurate.	Most diesel service /business information was accurate.	Very little diesel service/business information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Content	Diesel service /business content used was appropriate to the workplace, and student can explain why.	Diesel service /business content used was appropriate to the workplace.	Diesel service /business content used was slightly appropriate to the workplace.	Diesel Service/business content used was not appropriate to the workplace.	
				Total Score	

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric for Shop/Lab Safety Activity

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Accuracy	All safety information was accurate.	Almost all safety information was accurate.	Most safety information was accurate.	Very little safety information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Used more than 4 safety examples and showed considerable creativity and can clarify details	Used 3 to 4 safety examples and showed considerable creativity	Used 2 to 3 safety examples	Used 1 safety example	
Content	Diesel safety content used was appropriate to the workplace, and student can explain why.	Diesel safety content used was appropriate to the workplace.	Diesel safety content used was slightly appropriate to the workplace.	Diesel safety content used was not appropriate to the workplace.	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Presentation Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Used more than 4 trade journals or catalogs, contacted more than 1 vendor and obtained quote and information, and can clearly explain findings	Used 3 to 4 trade journals or catalogs, contacted 1 vendor and obtained quote and information, and can clearly explain findings	Used 2 to 3 trade journals or catalogs and contacted the vendor and obtained quote and information	Used 1 trade journals or catalogs and contacted the vendor	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Journal Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Writing Quality	There are a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There are a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of the complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of diesel service.	Content of the activity is related to life in general.	Only limited connections	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Job Sheet/Performance Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Safety	Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.	
Guidelines	Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.	
Diagnosis	Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.	
Customer Information	Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions.	
Written Information	Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	
				Total Score	

Name: _____

Date: _____

Period: _____

Guest Speaker Evaluation Form

Name of Speaker: _____

1. List five main ideas expressed in the presentation.

1. _____
2. _____
3. _____
4. _____
5. _____

2. Write a brief summary relating the topics of the presentation to your life.

_____
_____
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Name: _____

Date: _____

Period: _____

Team-Building and Participation Rubric

	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1	Score
Actively participates in team discussions and activities					
Encourages other team members to participate in discussions and activities					
Works with other members to keep the activity on schedule and task					
Shares ideas and thoughts					
Offers constructive recommendations					
Credits others for their contributions and ideas					
Empathizes with other members					
Requests input from others to reach an agreement					
Expresses ideas and thoughts					
Actively listens to other team members					
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Interpret MSDS Rubric

Your instructor will furnish you with the name of a chemical that is commonly used in diesel service occupations. You are to conduct a search of the Internet to locate a material safety data sheet (MSDS) for this material and use it to answer the following questions.

1. What is the Web address of the Internet site on which you found this information?

2. If you accidentally drank some of this material, what is the first aid procedure you would do first?

3. What special precautions should be taken in storing this material?

4. What is the flash point of this material?

5. If you spilled a small amount of this product, how would you clean it up?

6. What immediate effects would likely happen if you spilled some of this material on your skin?

Name: _____

Date: _____

Period: _____

Group Presentation Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Participation	Well-balanced participation by all group members	All group members have significant participation.	Most group members participate.	One main speaker with little participation from other group members	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				Total Score	

Name: _____

Date: _____

Period: _____

Resume Assessment Rubric

	Excellent 25 Points	Well Done 20 Points	Meets Standards 15 Points	Beginning 10 Points	No Evidence 0 Points	Score
Format	Resume contains name, address, objective, education, experience, and references. All words are spelled correctly.	Contains at least six of the criteria; no more than two spelling errors	Contains at least five of the criteria; no more than four spelling errors	Contains minimal information; more than four spelling errors	Assignment not submitted	
Education	Education includes all schools attended, graduation dates, diploma/degree awarded, and major field of study.	Education includes three of the criteria.	Education includes two of the criteria.	Education includes one of the criteria.	Assignment not submitted	
Experience	Experience includes internships, entry-level jobs, and current position.	Experience includes two of the criteria.	Experience includes one of the criteria.	Experience includes current position only.	Assignment not submitted	
Factual	Contains factual names and dates and is believable	Contains fairly believable names and dates	Resume has unrealistic dates or names.	Resume is unrealistic and contains conflicting information.	Assignment not submitted	
					Total Score	

Name: _____

Date: _____

Period: _____

Letter of Application Rubric

	Excellent 4 Points	Proficient 3 Points	Needs Improvement 2 points	Unsatisfactory 1 Point	Score
Layout/Design	Creatively designed and easily read; excellent business letter	Attractive and easy to read; good business letter	Appears busy or boring and is difficult to read; needs improvement	Unattractive or inappropriate and very difficult to read; not acceptable	
Information, Style, Audience, and Tone	Accurate and complete information; very well written and presented	Well written and interesting to read	Some information provided but is limited or inaccurate	Poorly written, inaccurate, or incomplete	
Accurate Parts	Complete with all required parts	Some elements may be missing.	Most elements are missing or out of place.	Proper form for a letter not used	
Grammar, Punctuation, and Wording	Excellent presentation, style, grammar, and punctuation	Fair presentation, style, grammar, and punctuation	Missing information and inaccurate punctuation and/or grammar	Poor grammar, punctuation, and wording	
Following Directions and Guidelines	Always on task and always followed directions	Followed directions with some guidance	Required a good bit of extra guidance	Did not follow directions and did not ask for extra help	
				Total Score	

Unit 2: Diesel Systems, Theories, and Components

Competency 1: Inspect, analyze, and perform service to diesel engine systems and components. DOK4 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Work order information must be accurate for the estimate/repair to be performed properly.
2. Engine components and systems must be inspected to ensure proper running condition.

Suggested Essential Questions

1. What type of information is needed to complete a work order?
2. Why does a diesel service technician need to inspect engine components and systems?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, and causes and corrections; determine needed repairs. (DOK 1) PRA1, PRA4	a. Take the class on a field trip to two diesel service facilities (one truck and one agriculture/construction). Have students record the customer–technician relationship; observe diagnosis, equipment usage, and correction of the problem. Have students exchange findings and critique and compare content of the two trips. Have students present findings to the class. CS1 CS2 CS4 CS5, T1 T2 T3 T4, E1 E2 E3 M1 M7 W1 W4 W5	a. Evaluate the field trip using the **Field Trip Checklist**. Evaluate presentation using the **Presentation Assessment Rubric**.
b. Identify and inspect diesel engine components and parts. (DOK 2)	b. Have students participate in a scavenger hunt. Give students a list of components, and have them search and identify the list in a given amount of time. Have students explain the purpose of each component and where it is located on a vehicle. Students will identify these components listed below: • Engine block • Pistons • Crankshaft • Camshaft • Supercharger • Flywheel • Vibration dampers • Valves • Connecting Rods Block components that are not within manufacturers' specifications CS1 CS5, T1 T3, E1 E2 E3 E4 E5 E6 M1 M7	b. Evaluate the scavenger hunt by using the **Scavenger Hunt Questionnaire**. Knowledge areas in which students appear lost or weak will be reviewed. Have students redo the exercise if they are weak in knowledge in those areas.
c. Analyze and	c. Have students use manuals, textbooks,	c. Evaluate the match-up worksheet using

diagnose engine noises according to manufacturer's specifications. (DOK 2) PRA1, PRA2, PRA4	and Web sites to match parts/components and systems to the various diesel components and systems. T1 T2 T3 T6, E1 E2 E3 E4 E6 M1 M2 M7 M8 W1 Using a diesel engine with engine noises, discuss issues related to problems and have the students observe and record the procedures to correct the problems. Explain and demonstrate each task. Have students perform the task(s). CS1 CS2, T1 T2, E1 E2 M1 M7 W1 W2 W3 Students will observe the instructor demonstrating the given task(s). Have each student perform the task(s). CS1, T1 T2 , E1 E2 M1 M7R1 • Inspect fuel, oil, and coolant levels, and condition; determine needed action. • Identify causes of engine fuel, oil, coolant, air, and other leaks; determine needed action. • Listen for engine noises; determine needed action. • Observe engine exhaust smoke color and quantity; determine needed action. • Identify causes of no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action. • Identify causes of surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action. • Identify engine vibration problems; determine needed action. • Check and record electronic diagnostic codes and trip/operational data; monitor electronic data; verify customer programmable parameters; clear codes; determine further diagnosis.	the **Match-Up Worksheet**. Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**. Evaluate the task(s) using the **Activity Performance Rubric**.

Competency 2: Analyze, diagnose, and perform skills related to cylinder head and valve train. DOK3 DST1 DST2 DST3 DST4

Suggested Enduring Understandings	**Suggested Essential Questions**
1. Accurately troubleshooting cylinder head and valve trains helps technicians keep them operating properly.	1. What components of a cylinder head and valve train require adjustments to ensure efficient operation? 2. What is the difference between a cylinder head and valve

2. Technicians must have knowledge about cylinder head and valve train components to effectively analyze systems.

train?

3. Before making repairs on a cylinder head and valve train, what steps should be completed?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Diagnose cylinder head components. (DOK 3) PRA1	a. Have students analyze different components from the cylinder head and valve train. Using the graph of various points of the cylinder head and valve train, have students determine how much the components are from being within manufacturers' specifications. Have students record steps and explanations of operation and information in their journals. CS1, T1 T2 T3, E1 E2 E3 E4 E5 E6 M1 M7	a. Evaluate the journal activity using the **Journal Rubric**.
b. Diagnose and perform procedures related to the valve trains. (DOK 3) PRA1	b. Using a cylinder head and valve train schematic, have the small groups of students interpret and troubleshoot the assigned components. Students should diagnose and determine the needed action and research appropriate service information. Have students record findings to the components(s) of a cylinder head. T1 T2 T3, E1 E2 M1 M7 S1	b. Evaluate using the **Job Sheet/ Performance Rubric**.
c. Inspect and repair various diesel engine components. (DOK 1)	c. Have students complete the case study activity. Have students research the Web site www.howstuffworks.com for diesel systems and/or components for three different models of vehicles that a diesel service technician might see. Compare the problems for the three vehicles and possible solutions. Have students record information in their journals. CS1 CS2, T1 T2 T3 E1 E2 M7 Identify and interpret the results using diagnostic procedures. The student will utilize a variety of resources to write a report concerning the procedures and the results. Have students record findings to the components(s) of a cylinder head. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5	c. Evaluate the journal activity using the **Journal Rubric.**
	d. Have students research environmental concerns. Students will create a Photostory (with audio) and present to the class. Have students record information in their journals. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5 e. Explain and demonstrate each task. Have students perform the task and complete the appropriate job sheet. Review the students' progress at the end of each competency, and re-teach as appropriate to ensure mastery. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5 Students will observe the instructor	d. Evaluate using the **Written Report Rubric**. Evaluate the presentation using the **Presentation Assessment Rubric**. The presentation should be loaded into the student's **Blackboard E-Portfolio** for future reference of skill attainment. Evaluate the journal using

	demonstrating the given task(s). Each student will inspect the following: CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5 • Remove, clean, inspect for visible damage, and replace cylinder head assembly. • Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action. • Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. • Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action. • Measure valve head height relative to deck and valve face-to-seat contact; determine needed action. • Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; determine needed action. • Inspect valve train components; determine needed action. • Reassemble cylinder head. • Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash; inspect; determine needed action. • Inspect cam followers; determine needed action. • Adjust valve bridges (crossheads); adjust valve clearances and injector settings.	the **Journal Rubric**. Evaluate using the **Job Sheet/ Performance Rubric**.

Competency 3: Inspect, determine correct procedures, and perform the repair technique(s) related to an engine block. DOK4 DST1 DST2 DST3 DST4

Suggested Enduring Understandings	**Suggested Essential Questions**
1. Proper block function and maintenance are important for the vehicle to function and perform properly. 2. Block wear and system wear may affect other components of the vehicle, which may require the technician to test other	1. What happens if blocks and their systems are not maintained properly or repaired correctly? 2. Why would other systems be affected by block wear or damage?

systems.

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Diagnose various block components and the replacement/repair procedures. (DOK 3) PRA1, PRA4	a. Research diesel engine block components. Discuss safety when working with blocks, and identify the other components of the system and their function and operation. Students will identify and inspect components listed below: • Valve train components • Intake manifold • Exhaust manifold • Cylinder liners • Blocks for cracks or wear • Loose fittings and supports • Block components that are not within manufacturers specifications CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5	a. Evaluate the discussion for content, clarity, and understanding.
b. Identify and discuss factors related to block component failure. (DOK 3)	b. Review MSDSs that are related to products that are used to maintain an engine block. Have students present information to the class related to the following topics: handling, storing, and usage of appropriate fluids/oils (dispose of in accordance with federal, state, and local regulations) and bleeding (manual, pressure, vacuum, or surge) a hydraulic brake system in accordance with manufacturer's procedures. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5	b. Evaluate the presentation using the **Presentation Assessment Rubric**.
c. Identify and discuss factors related to block system failure. (DOK 2) PRA1,PRA4	c. Have students compare and contrast the maintenance and repair process of a system related to a block. Have students develop and illustrate a timeline that shows the proper steps in the inspection, maintenance, and repair process of the block. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5 Have students observe the instructor demonstrating the given task(s) listed below: • Perform crankcase pressure test; determine needed action. • Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components. • Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for	c. Evaluate the timeline using text, manuals, or the Internet for accuracy. Have students correct any inaccuracies and present them to the class. Evaluate the timeline using the **Timeline Rubric**. Evaluate the presentation using the **Presentation Assessment Rubric**. The presentation should be loaded into the student's **Blackboard E-Portfolio** for future reference of skill attainment. Evaluate using the **Job Sheet/ Performance Rubric**.

~~warpage; check condition of passages, core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.~~

- ~~Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action.~~
- ~~Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action.~~
- ~~Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).~~
- ~~Inspect in-block camshaft bearings for wear and damage; determine needed action.~~
- ~~Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play.~~
- ~~Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action.~~
- ~~Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and correct crankshaft end play.~~
- ~~Inspect, install, and time gear train; measure gear backlash; determine needed action.~~
- ~~Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; perform needed action.~~
- ~~Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons.~~
- ~~Assemble pistons and connecting rods; install in block; install rod bearings, and check clearances.~~
- ~~Check condition of piston cooling jets (nozzles); determine needed action.~~
- ~~Inspect and measure crankshaft vibration damper; determine needed action.~~
- ~~Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s), and measure flywheel housing face and bore runout; determine needed action.~~

- Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action.

Have each student perform the task(s). CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.
PRA2 Apply properties to simplify algebraic expressions, solve linear equations and inequalities, and apply principles of graphing.
PRA4 Understand measurable attributes of objects and apply various formulas in problem-solving situations.

21st Century Learning Standards

CS1 Flexibility and Adaptability
CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

National Education Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

ACT College Readiness Standards

E1 Topic Development in Terms of Purpose and Focus
E2 Organization, Unity, and Coherence
E3 Word Choice in Terms of Style, Tone, Clarity, and Economy
E4 Sentence Structure and Formation
E5 Conventions of Usage
E6 Conventions of Punctuation
M1 Basic Operations and Applications
M2 Probability, Statistics, and Data Analysis
M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement
M8 Functions
R1 Main Ideas and Author's Approach
R2 Supporting Details
R3 Sequential, Comparative, and Cause–Effect Relationships
R4 Meaning of Words

~~R5 Generalizations and Conclusions~~
~~S1 Interpretation of Data~~
~~S2 Scientific Investigation~~
~~S3 Evaluation of Models, Inferences, and Experimental Results~~
~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

Association of Diesel Specialists. (n.d.) *Nozzle chatter*. Retrieved October 13, 2009, from http://www.diesel.org/

Automotive Service Association. (n.d.). *AutoInc*. Retrieved September 4, 2009, from http://www.autoinc.org/

National Institute for Automotive Service Excellence. (n.d.). *ASE blue seal news tech news*. Retrieved September 4, 2006, from http://www.ase.com

Texts

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinley Park, IL: Delmar Goodheart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

Bennett, S., & Norman, I. (2006). *Heavy duty truck systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1-4018-7064-3 (Workbook ISBN 1-4018-7065-1 and DVD 1-4018-7066-X available)

Videos

Films Media Group. (1993). *Diesel short block service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Films Media Group. (2005).Diesel injection system service. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Caterpillar. (n.d.). Retrieved October 1, 2009, from http://www.cat.org/

Cummins Engine Company. (n.d.). Retrieved October 1, 2009, from http://www.cummins.org/

Detroit Diesel. (n.d.). Retrieved October 1, 2009, from http://www.detoitdiesel.org/

Diesel Power. (n.d.). Retrieved October 1, 2009, from http://www.dieselpowermag.com/

How stuff works. (n.d.). Retrieved October 12, 2009, from http://www.howstuffworks.com/

John Deere. (n.d.). Retrieved October 7, 2009, from http://www.deere.org/

National Institute for Automotive Service Excellence. (n.d.). Retrieved September 12, 2009, from http://www.asecert.org/

Navistar International Corporation. (n.d.). Retrieved October 1, 2009, from http://www.navistar.org/

Paccar. (n.d.). Retrieved October 7, 2009, from http://www.paccar.org/

~~Suggested Rubrics and Checklists~~

Name: _____

Date: _____

Period: _____

Match-Up Worksheet

Place the letter from the description into the answer column that matches the appropriate item.

Answer	ITEM	DESCRIPTION
	Hoses	A. Push(es) water and coolant through the cooling system
	Belts	B. Hold(s) coolant and keeps the engine at a certain temperature
	Pressure cap	C. Regulate(s) pressure for the radiator
	Water pump	D. Hold(s) excess coolant from the radiator
	Coolant recovery system	E. Connect(s) the radiator to the water pump
	Radiator	F. Drive(s) the water pump from the crankshaft

Name: _____

Date: _____

Period: _____

Activity Performance Rubric

Task to Be Performed _____

	Possible Points	Points Awarded
Safety Personal safety (glasses, clothing, etc.) Safe use of tool Safely performs the task	25	
Performance of the Task Follows the task instructions Performs the task efficiently Performs the task satisfactorily	50	
Lab Maintenance Area cleanup (clean and tidy) Area organization (before, during, and after the task)	25	
Total	100	

Comments for Deductions:

Name: _____

Date: _____

Period: _____

Scavenger Hunt Questionnaire

Respond to the following:

1. What is the name of the component?

2. What is the purpose of the component?

3. Where is the component located on a vehicle?

4. Where can the component be purchased?

5. What is the cost of the component?

6. When should the component be repaired or replaced?

7. What is the cost of labor to replace or repair the component?

Name: _____

Date: _____

Period: _____

Field Trip Checklist

_____ 1. The student arrived at the designated meeting place on time with all materials and supplies required for the field trip.

_____ 2 The student observed all safety rules and policies while traveling to and participating in the field trip.

_____ 3. The student demonstrated interest in the content of the field trip by paying attention to the exhibits and speakers, asking pertinent questions, and taking notes.

_____ 4. The student exhibited a positive attitude toward the events and activities of the field trip.

_____ 5. The student remained on task throughout the field trip.

_____ 6. The student exhibited cooperative workplace skills with other students throughout the field trip.

Name: _____

Date: _____

Period: _____

Timeline Rubric

Scoring Criteria					
The student	**Excellent 4**	**Good 3**	**Needs Improvement 2**	**Unacceptable 1**	**Score**
Correctly identified three steps in the inspection process.					
Correctly designed a maintenance timeline including replace dates and inspection dates.					
Correctly identified the major steps in the repair process.					
				Total Score	

Name: _____

Date: _____

Period: _____

Job Sheet/Performance Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
	Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.	
	Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.	
	Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.	
	Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions.	
	Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	
				Total Score	

Name: _____

Date: _____

Period: _____

Journal Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Writing Quality	There are a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There are a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of the complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of diesel service.	Content of the activity is related to life in general.	Only limited connections	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Presentation Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Used more than 4 trade journals or catalogs, contacted more than 1 vendor and obtained quote and information, and can clearly explain findings	Used 3 to 4 trade journals or catalogs, contacted 1 vendor and obtained quote and information, and can clearly explain findings	Used 2 to 3 trade journals or catalogs, contacted the vendor and obtained quote and information	Used 1 trade journals or catalogs, contacted the vendor	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Written Report Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Clear thesis and focus that remain apparent	Thesis and focus that remain apparent	Addresses subject matter with minimal support	Does not focus on topic	
Grammar	Correct and effective use of grammar and mechanics	Occasional errors in use of grammar and mechanics	Problems in use of grammar and mechanics	Repeated errors in use of grammar and mechanics	
Organization	Ideas flow smoothly and logically with clarity and coherence.	Logical order and appropriate sequencing of ideas with adequate transition	Some evidence of an organizational plan or strategy	Lacks organization	
				Total Score	

Comments:

Unit 3: Electrical/Electronic Systems

Competency 1: Identify, analyze, and perform repair procedures to general electrical systems. DOK4 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Work order information must be accurate for the estimate or repair to be performed properly.
2. Accurately troubleshooting electrical/electronic systems helps technicians to repair them properly.
3. Technicians must have knowledge about voltage, current, and amperage to analyze systems.

Suggested Essential Questions

1. What type of information is needed to complete a work order?
2. What items on a vehicle require electrical current to operate or function?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Identify, analyze, and perform repair procedures to electrical/electronic systems and components. (DOK 3)	a. Using a wiring schematic, have the small groups of students interpret and troubleshoot the assigned system. Students should diagnose and determine the needed action and research appropriate electronic service information. Have students record findings to the given components(s) listed below: • Inspect, test, and replace/repair (if needed) • Fusible links • Circuit breakers • Fuses and switches • Relays • Bulbs • Sockets • Connectors • Wires of all interior and exterior light circuits *Note: Use proper self-grounding procedures for handling electrical components.* CS1 CS2, T1 T2 T3, E1 M1 M7 W1 W2 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Read and interpret electrical/electronic circuits using wiring diagrams. • Check continuity in electrical/electronic circuits using appropriate test equipment. • Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using appropriate test equipment. • Check current flow in electrical/electronic circuits and components using appropriate test equipment. • Check resistance in electrical/electronic circuits and components using appropriate	a. The **Activity Performance Rubric** or **Job Sheet/Performance Rubric** may be used to evaluate this activity. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

	test equipment. • Locate shorts, grounds, and opens in electrical/electronic circuits. • Identify parasitic (key-off) battery drain problems; perform tests; determine needed action. • Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed. • Inspect and test spike suppression devices; replace as needed. • Check frequency and pulse width signal in electrical/electronic circuits using appropriate test equipment.	
b. Analyze, evaluate, recommend, and perform necessary repairs to the components and systems related to the battery. (DOK 3) PRA1	b. Display a battery concern. Ask students to analyze and research the concern and use manuals, the Internet, and so forth to research parts, labor, and repair information. Ask students to share their findings using the Blackboard discussion board. Groups will then comment on findings of other groups. Examples are as follows: • Replace battery. • Replace battery cables. • Connectors/clamps • Perform a battery state-of-charge test. • Determine needed service. • Perform a slow/fast battery charge in accordance with manufacturer's recommendations. • Dispose of batteries and battery acid according to local, state, and federal requirements. CS1 CS2, T1 T2 T3 T4 T6, E1 M1 M7 W1 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill. • Perform battery load test; determine needed action. • Determine battery state of charge using an open circuit voltage test. • Inspect, clean, and service battery; replace as needed. • Inspect and clean battery boxes, mounts, and hold downs; repair or replace as needed. • Charge battery using slow or fast charge method as appropriate. • Inspect, test, and clean battery cables and connectors; repair or replace as needed. • Jump-start a vehicle using jumper cables and a booster battery or appropriate auxiliary	b. Monitor Blackboard comments, and assess students' knowledge through a summative assessment using a computer response system and/or Blackboard. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

	power supply using proper safety procedures. • Perform battery capacitance test; determine needed action.	
c. Evaluate, recommend, and perform repair procedures as they relate to the starting system. (DOK 2) PRA1, PRA4	c. Students will be provided with scenarios related to the problems with the starting system. The students will analyze the scenario and research repair procedures. They should record findings on the appropriate job sheet. T1 T2 T3 T4 T6, E1 M1 M7 W1 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Perform starter circuit cranking voltage and voltage drop tests; determine needed action. • Inspect and test components (key switch, push button, and/or magnetic switch) and wires in the starter control circuit; replace as needed. • Inspect and test starter relays and solenoids/switches; replace as needed. • Remove and replace starter; inspect flywheel ring gear or flex plate.	c. Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**. The job sheet should be loaded into the student's **Blackboard E-Portfolio** for future reference of skill attainment. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.
d. Diagnose and repair charging system. (DOK 3)	d. Display several concerns related to charging systems. Students can inspect and identify the charging system components and systems, determine the correct repair procedure, and perform the procedure. When the students have completed the repair procedure, they will discuss the operation with their classmates. Students will offer pros and cons of the procedure and record findings in their electronic journals. CS1 CS2, T1 T2 M1 M7 W1 W2 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: CS1 CS2, T1 T2 M1 M7 • Test instrument panel mounted volt meters and/or indicator lamps; determine needed action. • Identify causes of a no charge, low charge, or overcharge problems; determine needed action. • Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets; adjust drive belts and check alignment. • Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action.	d. Evaluate using the **Journal Rubric**. Evaluate using the **Activity Performance Rubric,** or the **Job Sheet/Performance Rubric** may be used to evaluate this activity. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

	• Perform charging circuit voltage drop tests; determine needed action. • Remove and replace alternator. • Inspect, repair, or replace cables, wires, and connectors in the charging circuit.	
e. Explore, analyze, and recommend proper repair procedures as they relate to lighting systems. (DOK 3) PRA1	e. Display a repair that is related to the teaching objective. Ask students to analyze and research the repair and use manuals, the Internet, and so forth to research parts, labor, and repair information. Ask students to share their findings using the Blackboard discussion board. Groups will then comment on findings of other groups. CS1 CS2, T1 T2 T3 T4 T6, E1 M1 M7 W1 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (including PC-based software and/or data scan tools); determine needed action. • Identify causes of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation. • Test, aim, and replace headlights. • Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules; repair or replace as needed. • Inspect and test switches, bulbs/LEDs, sockets, connectors, terminals, relays, wires, and control components/modules of parking, clearance, and taillight circuits; repair or replace as needed. • Inspect and test instrument panel light circuit switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed. • Inspect and test interior cab light circuit switches, bulbs, sockets, connectors, terminals, wires, and control components/modules; repair or replace as needed. • Inspect and test tractor-to-trailer multi-wire connector(s); repair or replace as needed. • Inspect, test, and adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors,	e. Monitor Blackboard comments, and assess students' knowledge through a summative assessment using a computer response system and/or Blackboard. Evaluate the task/job sheet using the **Job Sheet/Performance Rubric** or the **Lighting System Rubric**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

	terminals, wires and control components/modules; repair or replace as needed. • Inspect and test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules; repair or replace as needed. • Inspect and test reverse lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, wires and control components/modules; repair or replace as needed.	
f. Test and evaluate gauges and warning devices. (DOK 3) PRA1	f. Have students compare and contrast the maintenance and repair process of gauge and warning devices. Have students develop and illustrate a timeline that shows the proper steps in the inspection, maintenance, and repair process. CS1 CS2, T1 T2 T3 T4 T6, E1 M1 M7 W1 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Interface with vehicle's on-board computer; perform diagnostic procedure using recommended electronic diagnostic equipment and tools (including PC-based software and/or data scan tools); determine needed action. • Identify causes of intermittent, high, low, or no gauge readings; determine needed action. • Identify causes of data bus-driven gauge malfunctions; determine needed action. • Inspect and test gauge circuit sensor/sending units, gauges, connectors, terminals, and wires; repair or replace as needed. • Inspect and test warning devices (lights and audible) circuit sensor/sending units, bulbs/LEDs, sockets, connectors, wires, and control components/modules; repair or replace as needed. • Inspect, test, replace, and calibrate (if applicable) electronic speedometer, odometer, and tachometer systems.	f. Evaluate the timeline using text, manuals, or the Internet for accuracy. Have students correct any inaccuracies and present them to the class. Evaluate the timeline using the **Timeline Rubric**. Evaluate the task/job sheet using the **Job Sheet/Performance Rubric** or the **Warning Devices Rubric**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.
g. Identify, evaluate, and recommend replacement or repair procedures of related electrical systems**.**	g. Have students complete the case study activity. Have students research the Web site www.carcomplaints.com for restraint system complaints for three different vehicle year models. Compare the problems for the three	g. Evaluate the journal activity using the **Journal Rubric.** Evaluate the task/job

(DOK 3) PRA1	vehicles and possible solutions. Have students record information in their journals. CS1 CS2, T1 T2 T3 T4 T6, E1 M1 M7 W1 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (including PC-based software and/or data scan tools); determine needed action. • Identify causes of constant, intermittent, or no horn operation; determine needed action. • Inspect and test horn circuit relays, horns, switches, connectors, wires, and control components/modules; repair or replace as needed. • Identify causes of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems; determine needed action. • Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, wires and control components/modules; repair or replace as needed. • Inspect wiper motor transmission linkage, arms, and blades; adjust or replace as needed. • Inspect and test windshield washer motor or pump/relay assembly, switches, connectors, terminals, wires, and control components/modules; repair or replace as needed. • Inspect and test side-view mirror motors, heater circuit grids, relays, switches, connectors, terminals, wires and control components/modules; repair or replace as needed. • Inspect and test heater and A/C electrical components including: A/C clutches, motors, resistors, relays, switches, connectors, terminals, wires, and control components/modules; repair or replace as needed. • Inspect and test auxiliary power outlet, integral fuse, connectors, terminals, wires, and control components/modules; repair or replace as needed.	sheet using the **Job Sheet/Performance Rubric** or the **Related Electrical/Electronic Systems Rubric**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

	• ~~Identify causes of slow, intermittent, or no power side window operation; determine needed action.~~ • ~~Inspect and test motors, switches, relays, connectors, terminals, wires, and control components/modules of power side window circuits; repair or replace as needed.~~ • ~~Inspect and test block heaters; determine needed repairs.~~ • ~~Inspect and test cruise control electrical components; repair or replace as needed.~~ • ~~Inspect and test switches, relays, controllers, actuator/solenoids, connectors, terminals, and wires of electric door lock circuits.~~ • ~~Check operation of keyless and remote lock/unlock devices; determine needed action.~~ • ~~Inspect and test engine cooling fan electrical control components/modules; repair or replace as needed.~~ • ~~Identify causes of data bus communication problems; determine needed action.~~

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.
PRA4 Understand measurable attributes of objects and apply various formulas in problem-solving situations.

21st Century Learning Standards

CS1 Flexibility and Adaptability
CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

National Education Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

ACT College Readiness Standards

E1 Topic Development in Terms of Purpose and Focus
E2 Organization, Unity, and Coherence
E3 Word Choice in Terms of Style, Tone, Clarity, and Economy
E4 Sentence Structure and Formation
E5 Conventions of Usage
E6 Conventions of Punctuation
M1 Basic Operations and Applications
M2 Probability, Statistics, and Data Analysis
M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement
M8 Functions
R1 Main Ideas and Author's Approach
R2 Supporting Details
R3 Sequential, Comparative, and Cause–Effect Relationships
R4 Meaning of Words
R5 Generalizations and Conclusions
S1 Interpretation of Data
S2 Scientific Investigation
S3 Evaluation of Models, Inferences, and Experimental Results

~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

Association of Diesel Specialists. (n.d.) *Nozzle chatter*. Retrieved October 13, 2009, from http://www.diesel.org/

Automotive Service Association. (n.d.). *AutoInc.* Retrieved September 4, 2009, from http://www.autoinc.org/

National Institute for Automotive Service Excellence. (n.d.). *ASE blue seal news tech news.* Retrieved September 4, 2006, from http://www.ase.com

Texts

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinley Park, IL: Delmar Goodheart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

Bennett, S., & Norman, I. (2006). *Heavy duty truck systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1-4018-7064-3 (Workbook ISBN 1-4018-7065-1 and DVD 1-4018-7066-X available)

Videos

Films Media Group. (1993). *Diesel short block service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Films Media Group. (2005).Diesel injection system service. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Caterpillar. (n.d.). Retrieved October 1, 2009, from http://www.cat.org/

Cummins Engine Company. (n.d.). Retrieved October 1, 2009, from http://www.cummins.org/

Detroit Diesel. (n.d.). Retrieved October 1, 2009, from http://www.detoitdiesel.org/

Diesel Power. (n.d.). Retrieved October 1, 2009, from http://www.dieselpowermag.com/

How stuff works. (n.d.). Retrieved October 12, 2009, from http://www.howstuffworks.com/

John Deere. (n.d.). Retrieved October 7, 2009, from http://www.deere.org/

National Institute for Automotive Service Excellence. (n.d.). Retrieved September 12, 2009, from http://www.asecert.org/

Navistar International Corporation. (n.d.). Retrieved October 1, 2009, from http://www.navistar.org/

Paccar. (n.d.). Retrieved October 7, 2009, from http://www.paccar.org/

~~Suggested Rubrics and Checklists~~

Name: _____

Date: _____

Period: _____

Journal Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Writing Quality	There are a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There are a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of the complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of diesel service.	Content of the activity is related to life in general.	Only limited connections	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Activity Performance Rubric

Task to Be Performed _____

	Possible Points	Points Awarded
Safety Personal safety (glasses, clothing, etc.) Safe use of tool Safely performs the task	25	
Performance of the Task Follows the task instructions Performs the task efficiently Performs the task satisfactorily	50	
Lab Maintenance Area cleanup (clean and tidy) Area organization (before, during, and after the task)	25	
Total	100	

Comments for Deductions:

Name: _____

Date: _____

Period: _____

Job Sheet/Performance Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
	Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.	
	Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.	
	Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.	
	Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions.	
	Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	
				Total Score	

Name: _____

Date: _____

Period: _____

Lighting System Rubric

Rate the ability of the student to perform lighting system tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task, but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Safety procedures	
Use proper diagnostic procedures	
Identify concern	
Explain cause	
Correction of the concern	
Cleanup/disposal of containers and excess material	

Comments:

Name: _____

Date: _____

Period: _____

Warning Device Rubric

Rate the ability of the student to diagnose and repair warning devices using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task, but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Explanation (Student must explain job actions before beginning.)	
Safety procedures	
Properly uses tools	
Applies proper technique to the situation	
Identify concern	
Explain cause	
Correction of the concern	
Cleanup/disposal of tools and materials	

Explanation of procedure and/or comments:

Name: _____

Date: _____

Period: _____

Related Electrical/Electronic Systems Rubric

Rate the ability of the student to perform diagnostic and repair of electrical/electronic systems using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Explanation (Student must explain concern before beginning.)	
Safety procedures	
Explain cause	
Properly uses tools	
Applies proper technique to the situation	
Correction of the concern	
Cleanup/disposal	

Comments:

Name: _____

Date: _____

Period: _____

Timeline Rubric

Scoring Criteria					
The student	**Excellent 4**	**Good 3**	**Needs Improvement 2**	**Unacceptable 1**	**Score**
Correctly identified three steps in the inspection process					
Correctly designed a maintenance timeline including replace dates and inspection dates					
Correctly identified the major steps in the repair process					
				Total Score	

Unit 4: Preventive Maintenance and Inspection

Competency 1: Identify, evaluate, and repair engine systems and their components. DOK3 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Being aware of preventive maintenance procedures and schedules is crucial when evaluating and/or repairing a vehicle.
2. Preventive maintenance must be performed under guidelines that will not compromise the integrity of the vehicle, and it should be cost effective.

Suggested Essential Questions

1. Why are manufacturer's specifications important?
2. How will a technician know if preventive maintenance has been performed on a vehicle?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Identify and inspect, determine necessary action, and perform the procedure as it relates to diagnostic and repair operations to engine components. (DOK 3) PRA3	a. Have students role-play a given situation concerning frame diagnostic and repair operations to engine components. Have students choose to be a technician, a manager, a customer, or a parts specialist. Have students interact with each other in a variety of situations related to the concern. After each skit, the class will discuss the situations: pros and cons of each and how each will relate to a successful business. Have students record the results in their journals. T1 T2 T3 T4 T6, E1 E2 E3 E4 E6 M1 M7 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: • Check engine starting/operation (including unusual noises, vibrations, exhaust smoke, etc.); record idle and governed rpm. • Inspect vibration damper. • Inspect belts, tensioners, and pulleys; check and adjust belt tension; check belt alignment. • Check engine oil level and condition; check dipstick seal. • Inspect engine mounts for looseness and deterioration. • Check engine for oil, coolant, air, fuel, and exhaust leaks (Engine Off and Running). • Check engine compartment wiring harnesses, connectors, and seals for damage and proper routing.	a. Evaluate the journal activity using the **Journal Rubric**. Evaluate the skit using the **Role-Play or Skit Rubric for Employment Skills**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.
b. Identify, diagnose, recommend, and/or perform the necessary repair action as it relates to the fuel system. (DOK 3) PRA3	b. Have students role-play a customer concern situation related to preventive maintenance of the fuel system. Divide students into two groups: technicians and customers. Have technicians use appropriate graphic organizers (**Fact or Opinion** or the **Step-by-Step Chart**) to evaluate customers' concerns about a particular problem that relates to the	b. Evaluate the role-play using the **Role-Play or Skit Rubric**. Evaluate the graphic organizer (**Fact or Opinion** or **Step-by-Step Chart**) for clarity and content.

	current task being taught about preventive maintenance of the fuel system. Have technicians determine the needed action. CS1 CS2 CS5, T1 T2 T3 T4 T6, E1 E2 E3 E4 E5 E6 M1 M7 R1 R2 R3 W1 Have students observe the instructor demonstrating the given task(s). Have students work in groups and then individually to perform each skill: CS1 CS2 , T1 T2, M1 M7 • Check fuel tanks, mountings, lines, caps, and vents. • Drain water from fuel system. • Service water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system.	Evaluate using the **Fuel System Rubric**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.
c. Identify, practice, and evaluate air induction and exhaust systems. (DOK 3)	c. Divide the students into groups, and assign each group a component of the air induction and exhaust system. Have each group take pictures to create a poster displaying preventive maintenance task(s). The actual pictures from the assignment will be shown and discussed. CS1 CS2 CS4 CS5, T1 T2 T4 E1 M1 M7 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: CS1 CS5, M1 M7 • Check exhaust system mountings for looseness and damage. • Check engine exhaust system for leaks, proper routing, and damaged or missing components to include exhaust gas recirculation (EGR) system and after-treatment devices, if equipped. • Check air induction system: piping, charge air cooler, hoses, clamps, and mountings; check for air restrictions and leaks. • Inspect turbocharger for leaks; check mountings and connections. • Check operation of engine compression/exhaust brake. • Service or replace air filter as needed; check and reset air filter restriction indicator. • Inspect and service crankcase ventilation system.	c. Evaluate the poster using the **Poster Assessment Rubric**. Observe and correct students as they inspect the exhaust system. Evaluate using the **Exhaust System Rubric**. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.
d. Identify, practice, and evaluate cooling and lubrication systems. (DOK 3)	d. Divide the students into groups, and assign each group a cooling or lubrication system. Have each group take pictures to create a poster while inspecting the assigned system. The actual pictures from the assignment will	d. Evaluate the poster using the **Poster Assessment Rubric**. Observe and correct

	be shown and discussed. Be cautious when taking pictures of the cooling and lubrication systems. CS1 CS2 CS4 CS5, T1 T2 T4 E1 M1 M7 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill: CS1 CS5, M1 M7 • Check operation of fan clutch. • Inspect radiator (including air flow restriction, leaks, and damage) and mountings. • Inspect fan assembly and shroud. • Pressure test cooling system and radiator cap. • Inspect coolant hoses and clamps. • Inspect coolant recovery system. • Check coolant for contamination, additive package concentration, and protection level (freeze point). • Service coolant filter. • Inspect water pump for leaks and bearing play. • Change engine oil and filters; visually check oil for coolant or fuel contamination; inspect and clean magnetic drain plugs. • Take an engine oil sample.	students as they inspect and complete preventative maintenance procedures to the cooling and lubrication systems. Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.

Competency 2: Inspect, diagnose, and recommend repair procedures for components and systems related to the cab and hood. DOK 3 DST1 DST2 DST3 DST4

Suggested Enduring Understandings	**Suggested Essential Questions**
1. Correct analysis of frame damage is essential in vehicle repair. 2. To return a vehicle to manufacturer's specifications, the technician must be proficient in the skill of measuring. 3. All body repair must be performed under guidelines that will not compromise the integrity of the vehicle.	1. Why are manufacturer's specifications important? 2. How does a technician know what areas to repair and which to replace?

Suggested Performance Indicators	**Suggested Teaching Strategies**	**Suggested Assessment Strategies**
a. Identify and inspect; determine necessary procedures as they relate to the cab and hood. (DOK 3) PRA3	a. Have students role-play a given situation concerning frame inspection and repair. Have students choose to be a technician, a manager, a customer, or a parts specialist. Have students interact with each other in a variety of situations related to the concern. After each skit, the class will discuss the situations: pros and cons of each and how each will relate to a successful business. Have students record the results in their journals. T1 T2 T3 T4 T6, E1 E2 E3 E4 E6 M1 M7	a. Evaluate the journal activity using the **Journal Rubric**. Evaluate the skit using the **Role-Play or Skit Rubric for Employment Skills**. Provide feedback to students related to each skill

		~~Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill:~~ ~~• Inspect key condition and operation of ignition switch.~~ ~~• Check warning indicators.~~ ~~• Check instruments; record oil pressure and system voltage.~~ ~~• Check operation of electronic power take off (PTO) and engine idle speed controls (if applicable).~~ ~~• Check HVAC controls.~~ ~~• Check operation of all accessories.~~ ~~• Using diagnostic tool or on-board diagnostic system retrieve engine monitoring information and check and record diagnostic codes and trip/operational data (including engine, transmission, ABS, and other systems).~~ ~~• Check operation of electric/air horns and reverse warning devices.~~ ~~• Check condition of spare fuses, triangles, fire extinguisher, and all required decals.~~ ~~• Inspect seat belts and sleeper restraints.~~ ~~• Inspect wiper blades and arms.~~ ~~• Check operation of wiper and washer.~~ ~~• Inspect windshield glass for cracks or discoloration; check sun visor.~~ ~~• Check seat condition, operation, and mounting.~~ ~~• Check door glass and window operation.~~ ~~• Inspect steps and grab handles.~~ ~~• Inspect mirrors, mountings, brackets, and glass.~~ ~~• Record all observed physical damage.~~ ~~• Lubricate all cab and hood grease fittings.~~ ~~• Inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables.~~ ~~• Inspect cab mountings, hinges, latches, linkages and ride height; service as needed.~~	~~performed.~~ ~~Continue to provide lab opportunities to students until mastery is reached in each skill.~~
~~b. Identify, diagnose, and determine necessary procedures to electrical/electronic systems and components. (DOK 3)~~ ~~PRA3~~	~~b. Divide students into groups based on learning styles, and assign each to a specific repair related to preventive maintenance of electrical/electronic systems. Have each group compose guidelines for repair. Have each group role-play, create a multimedia presentation or a rap song, or write a story to discuss the proper and improper procedures related to the guideline.~~ ~~T1 T2 T3 T4, E1 E2 E3 M1 M7~~	~~b. Evaluate the skit using the **Role Play or Skit Rubric**.~~ ~~Evaluate using the **Preventive Maintenance Electrical/Electronic Rubric.**~~

	~~Have students observe the instructor demonstrating the given task(s). Have students work in groups and then individually to perform each skill:~~ ~~CS1 CS2~~ , ~~T1 T2~~, ~~M1 M7~~ • ~~Inspect battery box(es), cover(s), and mountings.~~ • ~~Inspect battery hold-downs, connections, cables, and cable routing; service as needed.~~ • ~~Check/record battery state of charge (open circuit voltage) and condition.~~ • ~~Perform battery test (load and/or capacitance).~~ • ~~Inspect starter, mounting, and connections.~~ • ~~Engage starter; check for unusual noises, starter drag, and starting difficulty.~~ • ~~Inspect alternator, mountings, cable, wiring, and wiring routing; determine needed action.~~ • ~~Perform alternator output tests.~~ • ~~Check operation of interior lights; determine needed action.~~ • ~~Check all exterior lights, lenses, reflectors, and conspicuity tape; check headlight alignment; determine needed action.~~ • ~~Inspect and test tractor-to-trailer multi-wire connector(s), cable(s), and holder(s); determine needed action. Drain water from fuel system.~~	~~Provide feedback to students related to each skill performed. Continue to provide lab opportunities to students until mastery is reached in each skill.~~

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA3 Identify and apply geometric principles to polygons, angles, and two- and three-dimensional figures.

21st Century Learning Standards

CS1 Flexibility and Adaptability
CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

National Education Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

ACT College Readiness Standards

E1 Topic Development in Terms of Purpose and Focus
E2 Organization, Unity, and Coherence
E3 Word Choice in Terms of Style, Tone, Clarity, and Economy
E4 Sentence Structure and Formation
E5 Conventions of Usage
E6 Conventions of Punctuation
M1 Basic Operations and Applications
M2 Probability, Statistics, and Data Analysis
M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement
M8 Functions
R1 Main Ideas and Author's Approach
R2 Supporting Details
R3 Sequential, Comparative, and Cause–Effect Relationships
R4 Meaning of Words
R5 Generalizations and Conclusions
S1 Interpretation of Data
S2 Scientific Investigation
S3 Evaluation of Models, Inferences, and Experimental Results

~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

Association of Diesel Specialists. (n.d.) *Nozzle chatter*. Retrieved October 13, 2009, from http://www.diesel.org/

Automotive Service Association. (n.d.). *AutoVIN*. Retrieved September 4, 2009, from http://www.autoinc.org/

National Institute for Automotive Service Excellence. (n.d.). *ASE blue seal news tech news*. Retrieved September 4, 2006, from http://www.ase.com

Texts

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinley Park, IL: Delmar Good heart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

Bennett, S., & Norman, I. (2006). *Heavy duty truck systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1-4018-7064-3 (Workbook ISBN 1-4018-7065-1 and DVD 1-4018-7066-X available)

Videos

Films Media Group. (1993). *Diesel short block service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Films Media Group. (2005). *Diesel injection system service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Caterpillar. (n.d.). Retrieved October 1, 2009, from http://www.cat.org/

Cummins Engine Company. (n.d.). Retrieved October 1, 2009, from http://www.cummins.org/

Detroit Diesel. (n.d.). Retrieved October 1, 2009, from http://www.detoitdiesel.org/

Diesel Power. (n.d.). Retrieved October 1, 2009, from http://www.dieselpowermag.com/

How stuff works. (n.d.). Retrieved October 12, 2009, from http://www.howstuffworks.com/

John Deere. (n.d.). Retrieved October 7, 2009, from http://www.deere.org/

National Institute for Automotive Service Excellence. (n.d.). Retrieved September 12, 2009, from http://www.asecert.org/

Navistar International Corporation. (n.d.). Retrieved October 1, 2009, from http://www.navistar.org/

Paccar. (n.d.). Retrieved October 7, 2009, from http://www.paccar.org/

~~Suggested Rubrics and Checklists~~

~~Name:~~ _____

~~Date:~~ _____

~~Period:~~ _____

~~Fact or Opinion~~

~~Write your topic in the top rectangle. Add details to the fact or the opinion block.~~

Topic:	
Fact:	Opinion:

~~Name:~~ _____

~~Date:~~ _____

~~Period:~~ _____

~~Step-by-Step Chart~~

~~Write the task that you are to accomplish in the task area. Determine and write each step of your procedure with details.~~

~~Task~~	
~~Step 1:~~	~~Details:~~
~~Step 2:~~	~~Details:~~
~~Step 3:~~	~~Details:~~
~~Step 4:~~	~~Details:~~
~~Step 5:~~	~~Details:~~
~~Step 6:~~	~~Details:~~

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Accuracy	All information was accurate.	Almost all information was accurate.	Most information was accurate.	Very little information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Props	Used several props and showed considerable creativity	Used one or two appropriate props that made the presentation better	Used one or two props that made the presentation better	Used no props to make the presentation better	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	
				Total Score	

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric for Employment Skills

	Exemplary 4 Points	**Accomplished 3 Points**	**Developing 2 Points**	**Beginning 1 Point**	**Score**
Accuracy	All information was accurate.	Almost all information was accurate.	Most information was accurate.	Very little information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Content	Used several props and showed considerable creativity	Used one or two appropriate props that made the presentation better	Used one or two props that made the presentation better	Used no props to make the presentation better	
				Total Score	

Name: _____

Date: _____

Period: _____

Poster Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Required Content	The poster includes all required content elements as well as additional information.	All required content elements are included on the poster.	All but one of the required content elements are included on the poster.	Several required content elements are missing.	
Labels	All items of importance on the poster are clearly labeled with labels that are easy to read.	Almost all items of importance on the poster are clearly labeled with labels that are easy to read.	Many items of importance on the poster are clearly labeled with labels that are easy to read.	Labels are too small to read, or no important items are labeled.	
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout, and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed.	
Grammar	There are no grammatical or mechanical mistakes on the poster.	There are 1 to 2 grammatical or mechanical mistakes on the poster.	There are 3 to 4 grammatical or mechanical mistakes on the poster.	There are more than 4 grammatical or mechanical mistakes on the poster.	
				Total Score	

Name: _____

Date: _____

Period: _____

Journal Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Writing Quality	There are a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There are a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of the complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of diesel service.	Content of the activity is related to life in general.	Only limited connections	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Fuel System Rubric

Rate the ability of the student to perform preventive maintenance fuel system tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Explanation (Student must explain concern before beginning.)	
Safety procedures	
Identifies components of the fuel system	
Explains cause	
Correction of the cause	
Properly uses tools	
Applies proper technique to the situation	

Explanation/comments:

Name: _____

Date: _____

Period: _____

Exhaust System Rubric

Rate the ability of the student to perform preventive maintenance to the exhaust system using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Explanation (Student must explain concern before beginning.)	
Safety procedures	
Inspects all components	
Identifies wear or components that are not within manufacturer's specifications	
Properly uses tools	
Identify cause	
Correction of the concern	
Cleanup/disposal	

Explanation/comments:

Name: _____

Date: _____

Period: _____

Preventive Maintenance Electrical/Electronic Rubric

Rate the ability of the student to perform preventive maintenance tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Explanation (Student must explain concern before beginning.)	
Safety procedures	
Identify cause	
Correction of the cause	
Properly uses tools	
Applies proper technique to the situation	
Monitors systems according to manufacturer's specifications	
Cleanup/disposal	

Explanation/comments:

Unit 5: Advanced Diesel Engine Performance

Competency 1: Identify, inspect, determine the action, and perform the procedure as it pertains to lubrication systems, cooling systems, air induction, and exhaust systems. DOK4 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. A diesel engine's performance and longevity are based on the quality of maintenance the engine has been given.
2. Fuel management, lubrication, and cooling systems must be maintained and repaired properly for the engine to operate with peak performance.

Suggested Essential Questions

1. What could happen if maintenance guidelines are not followed?
2. Why is it important that the lubrication and cooling systems be operating according to manufacturers specifications?
3. How does the fuel management system get contaminated?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Safety precautions, regulations, and guidelines for diesel engines (DOK 2) PRA1	a. Divide students into groups, and have them research local, state, and federal regulations that pertain to diesel engine emission standards. Have groups debate different sections of the regulations. CS1 CS2 CS5, T1 T2 T3 T4 , E1 E2 E3 E4 E5 E6 Guide students in how to properly complete the following. After guided practice, have each student perform each task individually: • Identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations. • Identify safety and personal health hazards according to OSHA guidelines and the Right to Know Law. • Identify emission guidelines for diesel engines.	a. Evaluate the debate using the **Debate Rubric**. Evaluate the safety activity using the **Safety Rubric I** and **Safety Rubric II**.
b. Analyze and demonstrate information for lubrication and cooling systems. (DOK 3) PRA1	b. Have students discuss what they already know about lubrication and cooling systems of diesel engines. Have students work as a class to complete a **KWL Chart**. (See also the **KWL Chart: Teacher Instructions** at the end of this unit.) In the "K" column, have students list information they currently know about lubrication and cooling systems of diesel engines. In the "W" column, have students brainstorm a list of things they want to learn about lubrication and cooling systems of diesel engines. Have students work in groups or as individuals to interview industry members to find answers to their "W" list. Have students return to the KWL chart and list everything they learned from the interviews in the "L" column. CS1 CS2 CS5, T1 T2 T3 T6, E1 E2 E3 E4 M1 M7 R1 R2 R3 W1 W2 Guide students how to properly complete the following. After guided practice, have each student perform each task individually: • Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit;	b. Have the students evaluate other's KWL projects and presentations for content. Monitor student activity, and evaluate the KWL project for content, clarity, and length. Revisit the **KWL Chart** after practice in the lab to see what areas still need to be addressed in instruction. Evaluate the task(s) using the **Advanced Diesel Engine Performance Rubric (Cooling System)** or

~~test engine oil temperature and check operation of temperature sensor; determine needed action.~~ • ~~Check engine oil level, condition, and consumption; determine needed action.~~ • ~~Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive gear clearances; determine needed action.~~ • ~~Inspect oil pressure regulator valve(s), bypass and pressure relief valve(s), oil thermostat, and filters; determine needed action.~~ • ~~Inspect, clean, and test oil cooler and components; determine needed action.~~ • ~~Inspect turbocharger lubrication and cooling systems; determine needed action.~~ • ~~Determine proper lubricant, and perform oil and filter change.~~ • ~~Inspect, test, and perform repair procedures related to cooling systems.~~ • ~~Check engine coolant type, level, condition, and consumption; test coolant for freeze protection and additive package concentration; determine needed action.~~ • ~~Test coolant temperature and check operation of temperature and level sensors, gauge, and/or sending unit; determine needed action.~~ • ~~Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment.~~ • ~~Inspect thermostat(s), bypasses, housing(s), and seals; replace as needed.~~ • ~~Recover, flush, and refill with recommended coolant/additive package; bleed cooling system.~~ • ~~Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed.~~ • ~~Inspect water pump and hoses; replace as needed.~~ • ~~Inspect, clean, and pressure test radiator, pressure cap, tank(s), and recovery systems; determine needed action.~~ • ~~Inspect, test, and perform necessary repair procedures related to air induction and exhaust systems.~~ • ~~Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; replace as needed.~~ • ~~Inspect turbocharger(s), wastegate, and piping systems; determine needed action.~~ • ~~Inspect and test turbocharger(s) (variable ratio/geometry VGT), pneumatic, hydraulic,~~	~~the **Advanced Diesel Engine Performance Rubric (Lubrication).**~~

electronic controls, and actuators.

- Check air induction system: piping, hoses, clamps, and mounting; service or replace air filter as needed.
- Remove and reinstall turbocharger/wastegate assembly.
- Inspect intake manifold, gaskets, and connections; replace as needed.
- Inspect, clean, and test charge air cooler assemblies; inspect after-cooler assemblies; replace as needed.
- Inspect exhaust manifold, piping, mufflers, and mounting hardware; repair or replace as needed.
- Inspect exhaust after treatment devices; determine necessary action.
- Inspect and test pre-heater/inlet air heater, or glow plug system and controls; perform needed action.
- Inspect and test exhaust gas recirculation (EGR) system including EGR valve, cooler, piping, filter, electronic sensors, controls, and wiring; determine needed action.

Competency 2: Determine failure cause(s), perform repair procedure, and evaluate procedure related to fuel systems and electronic fuel management systems. DOK3 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Fuel management systems must be maintained for the diesel engine to operate according to the manufacturer's specifications.
2. Engine brake repairs must be performed under guidelines that will not compromise the integrity of the engine brake components.

Suggested Essential Questions

1. What could happen if manufacturer's specifications are not followed when repairing or servicing a diesel engine?
2. Why is an engine brake used on a diesel engine?
3. How does a technician confirm that an engine brake is operating properly?
4. What could happen if manufacturer's specifications are not followed when repairing or servicing the engine brake components?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Diagnose, inspect, practice, and determine necessary procedures for fuel management system maintenance and repair procedures. (DOK 2)	a. Using a fuel management system schematic, have the small groups of students interpret and troubleshoot the system and its components. Students should diagnose and determine the needed action and research appropriate electronic service information. Have students record findings in journals. Guide students in how to properly complete the following. After guided practice, have each	a. Evaluate the journal using the **Journal Rubric**. Observe and correct students as they practice safety precautions for diesel engine systems and components.

~~student perform each task individually:~~

- ~~Check fuel level, and condition; determine needed action.~~
- ~~Perform fuel supply and return system tests; determine needed action.~~
- ~~Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, and supply and return lines and fittings; determine needed action.~~
- ~~Inspect, clean, and test fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware; determine needed action.~~
- ~~Inspect and test low-pressure regulator systems (check valves, pressure regulator valves, and restrictive fittings); determine needed action.~~
- ~~Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump.~~
- ~~Inspect, analyze, and perform the corrective repair procedure(s) related to the electronic fuel management systems~~
- ~~Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM); determine needed action.~~
- ~~Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (to include PC-based software and/or data scan tools); determine needed action.~~
- ~~Check and record electronic diagnostic codes and trip/operational data; monitor electronic data; clear codes; determine further diagnosis.~~
- ~~Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams).~~
- ~~Inspect and replace electrical connector terminals, seals, and locks.~~
- ~~Inspect and test switches, sensors, controls, actuator components, and circuits; adjust or replace as needed.~~
- ~~Using recommended electronic diagnostic tools (to include PC-based software and/or data scan tools), access and interpret customer programmable parameters.~~
- ~~Inspect, test, and adjust electronic unit injectors (EUI); determine needed action.~~

	• Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable). • Perform cylinder contribution test utilizing the recommended electronic diagnostic tool. • Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action. • Perform on-engine inspections and tests on hydraulic electronic unit injector high-pressure oil supply and control systems; determine needed action. • Perform on-engine inspections and tests on common rail type injection systems; determine needed action. • Inspect high-pressure injection lines, hold downs, fittings and seals; determine needed action.	
b. Inspect, analyze, and perform repairs related to engine brakes. (DOK 3)	b. Have students research environmental concerns. Students will create a Photostory (with audio) and present to the class. Have students record information in their journals. CS1 CS2 CS3 CS4 CS5, T1 T2 T3 T4 T5 T6, E1 E2 E3 E4 E5 E6 M1 M2 M3 M4 M5 M6 M7 M8 R1 R2 R3 R4 R5 S1 S2 S3 W1 W2 W3 W4 W5 Guide students how to properly complete the following. After guided practice, have each student perform each task individually: • Inspect and adjust engine compression/exhaust brakes; determine needed action. • Inspect, test, and adjust engine compression/exhaust brake control circuits, switches, and solenoids; repair or replace as needed. • Inspect engine compression/exhaust brake housing, valves, seals, lines, and fittings; repair or replace as needed.	b. Evaluate the presentation using the **Presentation Assessment Rubric**. Evaluate the journal using the **Journal Rubric**. Observe and correct students as they practice safety precautions for diesel engine systems and components.

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.

21st Century Learning Standards

CS1 Flexibility and Adaptability
CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

National Education Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

ACT College Readiness Standards

E1 Topic Development in Terms of Purpose and Focus
E2 Organization, Unity, and Coherence
E3 Word Choice in Terms of Style, Tone, Clarity, and Economy
E4 Sentence Structure and Formation
E5 Conventions of Usage
E6 Conventions of Punctuation
M1 Basic Operations and Applications
M2 Probability, Statistics, and Data Analysis
M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement
M8 Functions
R1 Main Ideas and Author's Approach
R2 Supporting Details
R3 Sequential, Comparative, and Cause–Effect Relationships
R4 Meaning of Words
R5 Generalizations and Conclusions
S1 Interpretation of Data
S2 Scientific Investigation
S3 Evaluation of Models, Inferences, and Experimental Results

~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

Association of Diesel Specialists. (n.d.) *Nozzle chatter*. Retrieved October 13, 2009, from http://www.diesel.org/

Automotive Service Association. (n.d.). *AutoInc*. Retrieved September 4, 2009, from http://www.autoinc.org/

National Institute for Automotive Service Excellence. (n.d.). *ASE blue seal news tech news*. Retrieved September 4, 2006, from http://www.ase.com

Texts

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinleypark, IL : Delmar Goodheart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

Bennett, S., & Norman, I. (2006). *Heavy duty truck systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1-4018-7064-3 (Workbook ISBN 1-4018-7065-1 and DVD 1-4018-7066-X available)

Videos

Films Media Group. (1993). *Diesel short block service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Films Media Group. (2005). *Diesel injection system service*. (Available in CD-ROM or DVD from Films Media Group, P.O. Box 2053, Princeton, NJ 08543, 1.800.257.5126, http://www.filmsmediagroup.com/)

Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Caterpillar. (n.d.). Retrieved October 1, 2009, from http://www.cat.org/

Cummins Engine Company. (n.d.). Retrieved October 1, 2009, from http://www.cummins.org/

Detroit Diesel. (n.d.). Retrieved October 1, 2009, from http://www.detoitdiesel.org/

Diesel Power. (n.d.). Retrieved October 1, 2009, from http://www.dieselpowermag.com/

How stuff works. (n.d.). Retrieved October 12, 2009, from http://www.howstuffworks.com/

John Deere. (n.d.). Retrieved October 7, 2009, from http://www.deere.org/

National Institute for Automotive Service Excellence. (n.d.). Retrieved September 12, 2009, from http://www.asecert.org/

Navistar International Corporation. (n.d.). Retrieved October 1, 2009, from http://www.navistar.org/

Paccar. (n.d.). Retrieved October 7, 2009, from http://www.paccar.org/

~~Suggested Rubrics and Checklists~~

Name: _____

Date: _____

Period: _____

Safety Rubric I

	Scoring Criteria			
The student	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1
Safety equipment				
Selects appropriate PPE.				
Wears protective clothing and eye protection.				
Demonstrates fire extinguisher operation.				
Subtotal for safety equipment				
Maintains clean facility				
Cleans area after tasks are complete.				
Stores materials properly.				
Subtotal for facility cleanliness				
Models appropriate behavior				
Observes safety rules.				
Follows written directions.				
Follows oral directions.				
Observes surroundings.				
Subtotal for appropriate behaviors				

Name: _____

Date: _____

Period: _____

Safety Rubric II

	Scoring Criteria			
The student	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1
Selects and uses tools				
Uses proper tools.				
Rejects unsafe tools.				
Carries tools properly.				
Cleans tools after use.				
Replaces tools upon completion.				
Observes electrical safety.				
Subtotal for tool selection				
Hazardous chemicals				
Observes label precautions.				
Handles chemicals properly.				
Provides adequate ventilation.				
Subtotal for chemical safety				
Summative Total				

Name: _____

Date: _____

Period: _____

Journal Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Writing Quality	There are a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There are a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of the complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of diesel service.	Content of the activity is related to life in general.	Only limited connections	
				Total Score	

Comments:

Name: _____

Date: _____

Period: _____

Debate Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Information	All information was accurate and clear.	Most information was accurate and clear.	Most information was accurate but not completely thorough or clear.	Information was inaccurate or needed clarification.	
Rebuttal	All counterarguments were accurate, relevant, and strong.	Most counter-arguments were accurate, relevant, and strong.	All counterarguments were accurate and relevant, but some were weak.	Counterarguments were not accurate or relevant.	
Organization	All arguments were logical and clearly followed a premise.	Most arguments were logical and clearly followed a premise.	Arguments were logical but did not always follow a premise.	Arguments were not logical and/or did not follow a premise.	
Understanding of the Topic	The individual/team clearly understood the topic fully and presented in a convincing manner.	The individual/team clearly understood the topic fully and presented with ease.	The individual/team understood the main points of the topic and presented those well.	The individual/team did not exhibit an adequate understanding of the topic.	
				Total Score	

KWL Chart: Teacher Instructions

Purposes

- To help students access prior knowledge through brainstorming
- To identify areas of student interest or concern
- To aid the teacher in planning lessons as well as checking for understanding
- To track student learning throughout the unit
- To identify areas for further student research/study

Process

- Use this strategy prior to, during, or at the close of any unit of study. The process can be done individually, in small groups, or as a class activity.
- Post the charts, or have students record their information in groups.
- During the brainstorming phase, emphasize getting lots of ideas rather than debating or discussing the ideas as they are generated. Debates, clarifications, and discussions of ideas occur once the brainstorming is over. Do not clarify any confusion or react in any way other than to record the data. Conflicting data may be recorded.
- During the lesson or unit of study, misconception, confusion, or curiosity should be addressed.

~~Name:~~ _____

~~Date:~~ _____

~~Period:~~ _____

~~KWL Chart~~

~~KNOW~~	~~WHAT TO KNOW~~	~~WHAT I LEARNED~~

Name: _____

Date: _____

Period: _____

Presentation Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, grammatically correct	Adequate, mostly accurate, few grammatical errors	Poorly planned, somewhat accurate, some grammatical errors	Weak, inaccurate, many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				Total Score	

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Accuracy	All information was accurate.	Almost all information was accurate.	Most information was accurate.	Very little information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Props	Used several props and showed considerable creativity	Used one or two appropriate props that made the presentation better	Used one or two props that made the presentation better	Used no props to make the presentation better	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	
				Total Score	

Name: _____

Date: _____

Period: _____

Advanced Diesel Engine Performance Rubric (Cooling System)

Rate the ability of the student to perform cooling system tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task, but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Safety procedures	
Addressed concern	
Correction of the concern	
Check cooling components	
Recover, flush, and fill	
Clean up and oil/materials	

Explanation/comments:

Name: _____

Date: _____

Period: _____

Advanced Diesel Engine Performance Rubric (Lubrication)

Rate the ability of the student to perform lubrication task (s) using the following scale:

4 – Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 – Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 – Introductory – Can perform the task, but some coaching and further training are required.
1 – Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	**Rating**
Safety procedures	
Addressed concern	
Correction of the concern	
Determine oil type	
Check oil level and condition	
Final stage inspected	
Cleanup/disposal	

Explanation/comments:

Unit 6: Auxiliary Components

Competency 1: Explore and analyze hydraulic systems, theories, and components. DOK3 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Safety practices must be followed at all times.
2. Hydraulic components must be maintained to operate properly.

Suggested Essential Questions

1. Why is safety important in all procedures? Give examples of what may happen if safety guidelines are not followed.
2. What are some possible causes for hydraulic failure?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Inspect, indentify, and evaluate general hydraulic system control valves; actuators; and hoses, fittings, connections, pumps and filtration/reservoirs (tanks). (DOK 3) PRA1	a. Assign students to groups of two or three to create a presentation on an assigned hydraulic component. Each group will identify and describe the function of the component. Discuss and demonstrate safety practices, concerns, causes of failure and corrections. Have students address each component listed below: CS1 CS2 CS3, T1 T2 T3 T4, E1 E2 E3 E4 M1 M7 • Actuator • Hoses • Control valve • Fitting • Connection • Pump • Filtration • Reservoirs **Safety practices and hazards will be reinforced as students participate in this activity.**	a. Evaluate using the **Presentation Assessment Rubric**. Evaluate using the **Hydraulic Components Rubric**.

Competency 2: Identify and inspect truck brake systems and steering/suspension components. DOK2 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Proper skills and knowledge of repairing truck brake and steering/suspension systems will restore the vehicle to the manufacturer's specifications and establish good customer relations.

Suggested Essential Questions

1. How can you tell that the truck brake and steering/suspension systems are/are not operating properly? What steps do you take to ensure proper operation?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Indentify, inspect, and analyze truck brake systems and steering/suspension components. (DOK 2)	a. Assign each student to the system being discussed. Have students research what their assigned part is and its function. Lead students in a classroom discussion about each part and how the parts work together to form a system. Students pretend they are the parts and will role-play how they function individually and as a system. Have students address each component listed below: CS1 CS2 CS3, T1 T2 T3 T4, E1 E2 E3 E4 M1 M7 • Tire • Rim	a. Monitor classroom discussion for content. Ensure that all students participate. Evaluate the skit using the **Role-Play or Skit Rubric**.

- Pittman arm
- Steering control arm
- Kingpin
- Power steering analyzer
- Steering gear CS1 CS2 CS4 CS5

Competency 3: Identify and evaluate agriculture/construction power train and components. DOK12 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Proper identification and understanding of the various components of a power train used in agriculture/construction equipment is essential in vehicle repair.

Suggested Essential Questions

1. How do power trains operate in order to move the equipment?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Inspect, identify, and diagnose agriculture/ construction power trains and components. (DOK 2)	a. Take the class on a field trip to two agriculture or construction equipment facilities. Have students record the customer–technician relationship and observe diagnosis, equipment usage, and correction of the problem. Have students exchange findings and critique and compare content of the two trips. Have students present findings to the class. CS1 CS2 CS4 CS5, T1 T2 T3 T4, E1 E2 E3 M1 M7 W1 W4 W5	**a.** Evaluate the field trip using the **Field Trip Checklist**. Evaluate presentation using the **Presentation Assessment Rubric**. The presentation should be loaded into the student's **Blackboard E-Portfolio** for future reference of skill attainment.

Competency 4: Indentify, perform and analyze welding and cutting techniques. DOK2 DST1 DST2 DST3 DST4

Suggested Enduring Understandings

1. Proper welding and cutting techniques are essential to restore a vehicle's integrity.

Suggested Essential Questions

1. Why should a welder be familiar with a workpiece before she or he begins welding?

Suggested Performance Indicators	Suggested Teaching Strategies	Suggested Assessment Strategies
a. Identify, analyze, and perform operations pertaining to welding. (DOK 2)	a. After demonstration of welding techniques by the instructor, divide students into groups. Each student will perform the welding task(s) and perform visual and destructive tests. If the weld fails either test, have the students determine why the weld failed. Have students perform the welding activity until the welds pass the tests. CS1 CS2 CS4 M1 M7 Provide guided practice in the form of modeling in the lab environment the following skills. Have students work in groups and then individually to perform each skill. As an enrichment activity, have students model basic employee responsibilities in a	a. The welding activity is complete when all welds pass the visual and destructive tests. Provide feedback to students related to each skill performed. Continue to provide lab

	~~skit.~~ ~~CS1 CS2 CS4 CS5~~ • ~~Perform the various welds: Continuous, stitch, tack, plug, butt weld with and without backing, and lap joints.~~ • ~~Perform visual and destructive tests on each weld type.~~ • ~~Identify the causes of various welding defects; make necessary adjustments.~~ • ~~Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments.~~ • ~~Identify and performthe cutting process for different materials and locations in accordance with manufacturer's procedures; perform the cutting operation.~~	~~opportunities to students until mastery is reached in each skill.~~ ~~Evaluate using the **Welding Rubric**.~~

Standards

Industry Standards

DST1 Diesel Systems and Components
DST2 Electrical/Electronic Systems
DST3 Diesel Engine Performance
DST4 Auxiliary Components and Systems

Applied Academic Credit Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.

21st Century Learning Standards

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CS2 Initiative and Self-Direction
CS3 Social and Cross-Cultural Skills
CS4 Productivity and Accountability
CS5 Leadership and Responsibility

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T5 Digital Citizenship
T6 Technology Operations and Concepts

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M3 Numbers: Concepts and Properties
M4 Expressions, Equations, and Inequalities
M5 Graphical Representations
M6 Properties of Plane Figures
M7 Measurement
M8 Functions
R1 Main Ideas and Author's Approach
R2 Supporting Details
R3 Sequential, Comparative, and Cause–Effect Relationships
R4 Meaning of Words
R5 Generalizations and Conclusions
S1 Interpretation of Data
S2 Scientific Investigation
S3 Evaluation of Models, Inferences, and Experimental Results

~~W1 Expressing Judgments~~
~~W2 Focusing on the Topic~~
~~W3 Developing a Position~~
~~W4 Organizing Ideas~~
~~W5 Using Language~~

References

Journals

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Texts

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Bennett, S., (2007). *Modern diesel technology, brakes, steering, and suspension*. Clifton Park, NY: Thomson Delmar Learning. ISBN 1418013722

Daines, J. (2009). *Fluid power: Hydraulics and pneumatics*. Tinley Park, IL: Delmar Goodheart-Wilcox. ISBN: 978-1-60525-081-6. (Instructor's text, student workbook, and interactive DVD available)

Huzij, R., Spano, A., & Bennett, S., (2009). *MDT: Heavy equipment systems*. Clifton Park, NY: Thomson Delmar Learning. ISBN 14238319999

Norman, A., & Corinchock, J. (2008). *Diesel technology*. Tinley Park, IL: Delmar Goodheart-Wilcox. ISBN 978-1-59070-770-8. (Instructor's text, student workbook, and interactive DVD available)

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Web Sites

Biodiesel. (n.d.). Retrieved October 1, 2009, from http://www.biodiesel.org/

Caterpillar. (n.d.). Retrieved October 1, 2009, from http://www.cat.org/

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Paccar. (n.d.). Retrieved October 7, 2009, from http://www.paccar.org/

~~Suggested Rubrics and Checklists~~

Name: _____

Date: _____

Period: _____

Presentation Assessment Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, grammatically correct	Adequate, mostly accurate, few grammatical errors	Poorly planned, somewhat accurate, some grammatical errors	Weak, inaccurate, many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				Total Score	

Name: _____

Date: _____

Period: _____

Hydraulic Component Rubric

	Scoring Criteria			
The student	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1
Safety equipment				
Selects appropriate PPE.				
Wears protective clothing and eye protection.				
Subtotal for safety equipment				
Hydraulic components				
Inspects control valves.				
Inspects actuators.				
Inspects hoses.				
Inspects fittings and connections.				
Inspects filtration.				
Inspects reservoirs.				
Subtotal for facility cleanliness				
If there is a concern, continue below:				
Addressed concern.				
Identified cause.				
Corrected the concern.				
Subtotal for appropriate behaviors				

Name: _____

Date: _____

Period: _____

Welding Rubric

	Scoring Criteria			
The student	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1
Safety				
Uses proper helmet.				
Uses proper covering (gloves, shoes, and body cover).				
Subtotal for safety selection				
Welding skills				
Performs continuous weld.				
Performs stitch weld.				
Performs tack weld.				
Performs plug weld.				
Performs butt with backing weld.				
Performs butt without backing weld.				
Welds pass destructive tests.				
Welds pass visual tests.				
Subtotal for welding				
Summative Total				

Name: _____

Date: _____

Period: _____

Role-Play or Skit Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Accuracy	All information was accurate.	Almost all information was accurate.	Most information was accurate.	Very little information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Props	Used several props and showed considerable creativity	Used one or two appropriate props that made the presentation better	Used one or two props that made the presentation better	Used no props to make the presentation better	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	
				Total Score	

Name: _____

Date: _____

Period: _____

Field Trip Checklist

_____ 1. The student arrived at the designated meeting place on time with all materials and supplies required for the field trip.

_____ 2 The student observed all safety rules and policies while traveling to and participating in the field trip.

_____ 3. The student demonstrated interest in the content of the field trip by paying attention to the exhibits and speakers, asking pertinent questions, and taking notes.

_____ 4. The student exhibited a positive attitude toward the events and activities of the field trip.

_____ 5. The student remained on task throughout the field trip.

_____ 6. The student exhibited cooperative workplace skills with other students throughout the field trip.

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Fundamentals of Diesel Systems and Components

_____ 1. Introduce, describe, and distinguish local program and vocational/career–technical center policies and procedures.

_____ 2. Introduce, describe, and express employment opportunities and responsibilities of the diesel service industry.

_____ 3. Investigate and replicate leadership skills and personal development.

_____ 4. Model general safety rules for working in a shop/lab and an industry setting

_____ 5. Interpret and apply service specifications and information.

_____ 6. Demonstrate measurement practices used in the diesel service industry.

_____ 7. Manage personal and business finances to include aspects of employer–employee decision making and consumer credit.

Unit 2: Diesel Systems, Theories, and Components

_____ 1. Inspect, analyze, and perform service to diesel engine systems and components.

_____ 2. Analyze, diagnose, and perform skills related to cylinder head and valve train.

_____ 3. Inspect, determine correct procedures, and perform the repair technique(s) related to an engine block.

Unit 3: Electrical/Electronic Systems

_____ 1. Identify, analyze, and perform repair procedures to general electrical systems.

Unit 4: Preventive Maintenance and Inspection

_____ 1. Identify, evaluate, and repair engine systems and their components.

_____ 2. Inspect, diagnose, and recommend repair procedures for components and systems related to the cab and hood.

Unit 5: Advanced Diesel Engine Performance

_____ 1. Identify, inspect, determine the action, and perform the procedure as it pertains to lubrication systems, cooling systems, air induction, and exhaust systems.

_____ 2. Determine failure cause(s), perform repair procedure, and evaluate procedure related to fuel systems and electronic fuel management systems.

Unit 6: Auxiliary Components

_____ 1. Explore and analyze hydraulic systems, theories, and components.

2. ~~Identify and inspect truck brake systems and steering/suspension components.~~

3. ~~Identify and evaluate agriculture/construction power train and components.~~

4. ~~Identify, perform, and analyze welding and cutting techniques.~~

Appendix A: 21st Century Skills Standards

CLS1 Flexibility and Adaptability
CLS2 Initiative and Self-Direction
CLS3 Social and Cross-Cultural Skills
CLS4 Productivity and Accountability
CLS5 Leadership and Responsibility

Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills.

CS 1 Flexibility and Adaptability

- Adapting to varied roles and responsibilities
- Working effectively in a climate of ambiguity and changing priorities

CS 2 Initiative and Self-Direction

- Monitoring one's own understanding and learning needs
- Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
- Demonstrating initiative to advance skill levels toward a professional level
- Defining, prioritizing, and completing tasks without direct oversight
- Utilizing time efficiently and managing workload
- Demonstrating commitment to learning as a lifelong process

CS 3 Social and Cross-Cultural Skills

- Working appropriately and productively with others
- Leveraging the collective intelligence of groups when appropriate
- Bridging cultural differences and using differing perspectives to increase innovation and the quality of work

CS 4 Productivity and Accountability

- Setting and meeting high standards and goals for delivering quality work on time
- Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)

CS 5 Leadership and Responsibility

- Using interpersonal and problem-solving skills to influence and guide others toward a goal
- Leveraging strengths of others to accomplish a common goal
- Demonstrating integrity and ethical behavior
- Acting responsibly with the interests of the larger community in mind

Appendix B: Mississippi Academic Standards

Pre-Algebra

PRA1 Apply concepts and perform basic operations using real numbers in real-world contexts.

PRA2 Apply properties to simplify algebraic expressions, solve linear equations and inequalities, and apply principles of graphing.

PRA3 Identify and apply geometric principles to polygons, angles, and two- and three-dimensional figures.

PRA4 Understand measurable attributes of objects and apply various formulas in problem-solving situations.

PRA5 Interpret, organize, and make predictions about a variety of data using concepts of probability.

1. Apply concepts and perform basic operations using real numbers in real-world contexts.

a. Define, classify, and order rational and irrational numbers and their subsets. (DOK 1)
b. Formulate and solve standard and real-life problems involving addition, subtraction, multiplication, and division of rational numbers. (DOK 2)
c. Apply the concepts of greatest common factor (GCF) and least common multiple (LCM) to monomials with variables. (DOK 2)
d. Simplify and evaluate expressions using order of operations, and use real number properties to justify solutions. (DOK 2)
e. Explain the rules of exponents related to multiplication and division of terms with exponents. (DOK 2)
f. Recognize and appropriately use exponential and scientific notation. (DOK 1)
g. Explain and use the inverse relationship between square roots and squares. (DOK 2)

2. **Apply properties to simplify algebraic expressions and solve linear equations and inequalities, and apply principles of graphing**.

a. Simplify and evaluate numerical and algebraic expressions. (DOK 1)
b. Apply properties of real numbers with an emphasis on the distributive properties of multiplication over addition and subtraction. (DOK 1)
c. Solve and check equations and inequalities using one variable. (DOK 2)
d. Model inequalities (and their solutions) on a number line. (DOK 1)
e. Graph linear equations and nonlinear equations ($y = x^2$) using multiple methods including t-tables and slope–intercept. (DOK 2)
f. Given a linear graph, identify its slope as positive, negative, undefined, or zero, and interpret slope as rate of change. (DOK 2)
g. Determine slope, x-intercept, and y-intercept from a graph and/or equation in slope–intercept or standard form. (DOK 1)
h. Add, subtract, and multiply monomials and binomials. (DOK 1)
i. Predict characteristics of a graph given an equation or t-table. (DOK 2)

3. Identify and apply geometric principles to polygons, angles, and two- and three-dimensional figures.

a. Locate and identify angles formed by parallel lines cut by a transversal(s) (e.g., adjacent, vertical, complementary, supplementary, corresponding, alternate interior, and alternate exterior). (DOK 1)
b. Find missing angle measurements for parallel lines cut by a transversal(s) and for a vertex of a polygon. (DOK 1)
c. Explain the Pythagorean theorem, and apply it to solve routine and non-routine problems. (DOK 3)
d. Solve real-world and non-routine problems involving congruent and similar figures. (DOK 3)
e. Use two-dimensional representations (nets) of three-dimensional objects to describe objects from various perspectives. (DOK 2)

4. Understand measurable attributes of objects, and apply various formulas in problem-solving situations.

a. Solve real-world application problems that include length, area, perimeter, and circumference using standard measurements. (DOK 2)
b. Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios. (DOK 3)
c. Use formulas and/or appropriate measuring tools to find length and angle measures (to appropriate levels of precision), perimeter, area, volume, and surface area of polygons, circles, spheres, cones, pyramids, and composite or irregular figures. (DOK 1)

5. **Interpret, organize, and make predictions about a variety of data using concepts of probability.**
   a. Use a given mean, mode, median, and range to summarize and compare data sets including investigation of the different effects that change in data values have on these measures. (DOK 2)
   b. Select the appropriate measures of central tendency for a particular purpose. (DOK 2)
   c. Make and list conjectures by calculating probability for experimental or simulated contexts. (DOK 3)
   d. Construct and interpret scatterplots to generalize trends from given data sets. (DOK 3)

Survey of Mathematical Topics

SMT1 Compute, analyze, and develop a variety of skills necessary to manage personal and business finance to include aspects of employer–employee decision-making and consumer credit.
SMT2 Identify and apply the practices that affect employer and employee decision-making.
SMT3 Demonstrate an understanding of the impact of consumer credit.
SMT4 Collect and apply information for planning a trip.

1. **Compute, analyze, and develop a variety of skills necessary to manage personal and business finance to include aspects of employer–employee decision-making and consumer credit.**
   a. Develop a household budget. (DOK 2)
   b. Use and apply basic accounting procedures to maintain and balance a checkbook. (DOK 2)
   c. Identify the terminology of and apply the process of filing personal income tax. (DOK 2)
   d. Identify and explain the components and processes involved in the purchase, operation, and maintenance of a personal vehicle. (DOK 2)
   e. Determine the advantages and disadvantages of housing alternatives. (DOK 2)
   f. Use information and data to make sound decisions regarding personal savings. (DOK 3)
   g. Identify life and health insurance terminology, and apply it to real-world situations. (DOK 2)
   h. Compute and compare various forms of earnings, and calculate gross pay, deductions, and net pay. (DOK 2)
   i. Compare and contrast the finances of credit cards. (DOK 2)
   j. Identify and evaluate modes of transportation. (DOK 2)
   k. Identify and explain the components and processes involved in the stock market, and apply them to real-world applications. (DOK 2)

2. **Identify and apply the practices that affect employer and employee decision-making.**
   a. Identify and apply appropriate algebraic formulas to personal finance situations. (DOK 2)
   b. Apply linear programming to business decisions. (DOK 2)
   c. Identify and apply appropriate algebraic formulas to personal and business investments. (DOK 2)

3. **Demonstrate an understanding of the impact of consumer credit.**
   a. Identify and explain the advantages and disadvantages of installment loans. (DOK 2)
   b. Identify and apply appropriate algebraic formulas to consumer credit. (DOK 2)

4. **Collect and apply information for planning a trip.**
   a. Investigate and evaluate modes of transportation. (DOK 2)
   b. Create a travel budget. (DOK 2)
   c. Make travel plans based upon airline schedules. (DOK 2)

d. Apply map-reading skills. (DOK 1)
e. Apply appropriate formulas used for planning a trip. (DOK 1)

Appendix C: ACT College Readiness Standards

English

E1 Topic Development in Terms of Purpose and Focus

- Identify the basic purpose or role of a specified phrase or sentence.
- Delete a clause or sentence because it is obviously irrelevant to the essay.
- Identify the central idea or main topic of a straightforward piece of writing.
- Determine relevancy when presented with a variety of sentence-level details.
- Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal.
- Delete material primarily because it disturbs the flow and development of the paragraph.
- Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement.
- Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence or to determine the need to delete plausible but irrelevant material.
- Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation.
- Determine whether a complex essay has accomplished a specific purpose.
- Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay.

E2 Organization, Unity, and Coherence

- Use conjunctive adverbs or phrases to show time relationship in simple narrative essays (e.g., *then, this time*, etc).
- Select the most logical place to add a sentence in a paragraph.
- Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first, afterward, in response*).
- Decide the most logical place to add a sentence in an essay.
- Add a sentence that introduces a simple paragraph.
- Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore, however, in addition*).
- Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
- Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward.
- Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs.
- Rearrange sentences to improve the logic and coherence of a complex paragraph.
- Add a sentence to introduce or conclude a fairly complex paragraph.
- Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay.

E3 Word Choice in Terms of Style, Tone, Clarity, and Economy

- Revise sentences to correct awkward and confusing arrangements of sentence elements.
- Revise vague nouns and pronouns that create obvious logic problems.
- Delete obviously synonymous and wordy material in a sentence.
- Revise expressions that deviate from the style of an essay.
- Delete redundant material when information is repeated in different parts of speech (e.g., *alarmingly startled*).

- ~~Use the word or phrase most consistent with the style and tone of a fairly straightforward essay.~~
- ~~Determine the clearest and most logical conjunction to link clauses.~~
- ~~Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.~~
- ~~Identify and correct ambiguous pronoun references.~~
- ~~Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay.~~
- ~~Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., *an aesthetic viewpoint* versus *the outlook of an aesthetic viewpoint*).~~
- ~~Correct vague and wordy or clumsy and confusing writing containing sophisticated language.~~
- ~~Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.~~

~~E4 Sentence Structure and Formation~~

- ~~Use conjunctions or punctuation to join simple clauses.~~
- ~~Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences.~~
- ~~Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences.~~
- ~~Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.~~
- ~~Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers).~~
- ~~Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems.~~
- ~~Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence.~~
- ~~Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs.~~
- ~~Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.~~
- ~~Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses.~~

~~E5 Conventions of Usage~~

- ~~Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives.~~
- ~~Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject–verb and pronoun–antecedent agreement, and which preposition to use in simple contexts.~~
- ~~Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*.~~
- ~~Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for, appeal to*).~~
- ~~Ensure that a verb agrees with its subject when there is some text between the two.~~
- ~~Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences.~~
- ~~Identify the correct past and past participle forms of irregular and infrequently used verbs and form present–perfect verbs by using *have* rather than *of*.~~
- ~~Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom*.~~
- ~~Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject–verb order is inverted or when the subject is an indefinite pronoun).~~
- ~~Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas.~~
- ~~Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb.~~

E6 Conventions of Punctuation

- Delete commas that create basic sense problems (e.g., between verb and direct object).
- Provide appropriate punctuation in straightforward situations (e.g., items in a series).
- Delete commas that disturb the sentence flow (e.g., between modifier and modified element).
- Use commas to set off simple parenthetical phrases.
- Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause).
- Use punctuation to set off complex parenthetical phrases.
- Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*).
- Use apostrophes to indicate simple possessive nouns.
- Recognize inappropriate uses of colons and semicolons.
- Use commas to set off a nonessential/nonrestrictive appositive or clause.
- Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical).
- Use an apostrophe to show possession, especially with irregular plural nouns.
- Use a semicolon to indicate a relationship between closely related independent clauses.
- Use a colon to introduce an example or an elaboration.

Math

M1 Basic Operations and Applications

- Perform one-operation computation with whole numbers and decimals.
- Solve problems in one or two steps using whole numbers.
- Perform common conversions (e.g., inches to feet or hours to minutes).
- Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent.
- Solve some routine two-step arithmetic problems.
- Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average.
- Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour).
- Solve word problems containing several rates, proportions, or percentages.
- Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings).

M2 Probability, Statistics, and Data Analysis

- Calculate the average of a list of positive whole numbers.
- Perform a single computation using information from a table or chart.
- Calculate the average of a list of numbers.
- Calculate the average, given the number of data values and the sum of the data values.
- Read tables and graphs.
- Perform computations on data from tables and graphs.
- Use the relationship between the probability of an event and the probability of its complement.
- Calculate the missing data value, given the average and all data values but one.
- Translate from one representation of data to another (e.g., a bar graph to a circle graph).
- Determine the probability of a simple event.
- Exhibit knowledge of simple counting techniques.*
- Calculate the average, given the frequency counts of all the data values.
- Manipulate data from tables and graphs.

- ~~Compute straightforward probabilities for common situations.~~
- ~~Use Venn diagrams in counting.*~~
- ~~Calculate or use a weighted average.~~
- ~~Interpret and use information from figures, tables, and graphs.~~
- ~~Apply counting techniques.~~
- ~~Compute a probability when the event and/or sample space is not given or obvious.~~
- ~~Distinguish between mean, median, and mode for a list of numbers.~~
- ~~Analyze and draw conclusions based on information from figures, tables, and graphs.~~
- ~~Exhibit knowledge of conditional and joint probability.~~

~~M3 Numbers: Concepts and Properties~~

- ~~Recognize equivalent fractions and fractions in lowest terms.~~
- ~~Recognize one-digit factors of a number.~~
- ~~Identify a digit's place value.~~
- ~~Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor.~~
- ~~Find and use the least common multiple.~~
- ~~Order fractions.~~
- ~~Work with numerical factors.~~
- ~~Work with scientific notation.~~
- ~~Work with squares and square roots of numbers.~~
- ~~Work problems involving positive integer exponents.*~~
- ~~Work with cubes and cube roots of numbers.*~~
- ~~Determine when an expression is undefined.*~~
- ~~Exhibit some knowledge of the complex numbers.†~~
- ~~Apply number properties involving prime factorization.~~
- ~~Apply number properties involving even and odd numbers and factors and multiples.~~
- ~~Apply number properties involving positive and negative numbers.~~
- ~~Apply rules of exponents.~~
- ~~Multiply two complex numbers.†~~
- ~~Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers .~~
- ~~Exhibit knowledge of logarithms and geometric sequences.~~
- ~~Apply properties of complex numbers.~~

~~M4 Expressions, Equations, and Inequalities~~

- ~~Exhibit knowledge of basic expressions (e.g., identify an expression for a total as b + g).~~
- ~~Solve equations in the form x + a = b, where a and b are whole numbers or decimals.~~
- ~~Substitute whole numbers for unknown quantities to evaluate expressions.~~
- ~~Solve one-step equations having integer or decimal answers.~~
- ~~Combine like terms (e.g., 2x + 5x).~~
- ~~Evaluate algebraic expressions by substituting integers for unknown quantities.~~
- ~~Add and subtract simple algebraic expressions.~~
- ~~Solve routine first-degree equations.~~
- ~~Perform straightforward word-to-symbol translations.~~
- ~~Multiply two binomials.*~~
- ~~Solve real-world problems using first-degree equations.~~
- ~~Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions).~~
- ~~Identify solutions to simple quadratic equations.~~
- ~~Add, subtract, and multiply polynomials.*~~

- ~~Factor simple quadratics (e.g., the difference of squares and perfect square trinomials).*~~
- ~~Solve first-degree inequalities that do not require reversing the inequality sign.*~~
- ~~Manipulate expressions and equations.~~
- ~~Write expressions, equations, and inequalities for common algebra settings.~~
- ~~Solve linear inequalities that require reversing the inequality sign.~~
- ~~Solve absolute value equations.~~
- ~~Solve quadratic equations.~~
- ~~Find solutions to systems of linear equations.~~
- ~~Write expressions that require planning and/or manipulating to accurately model a situation.~~
- ~~Write equations and inequalities that require planning, manipulating, and/or solving.~~
- ~~Solve simple absolute value inequalities.~~

~~M5 Graphical Representations~~

- ~~Identify the location of a point with a positive coordinate on the number line.~~
- ~~Locate points on the number line and in the first quadrant.~~
- ~~Locate points in the coordinate plane.~~
- ~~Comprehend the concept of length on the number line.*~~
- ~~Exhibit knowledge of slope.*~~
- ~~Identify the graph of a linear inequality on the number line.*~~
- ~~Determine the slope of a line from points or equations.*~~
- ~~Match linear graphs with their equations.*~~
- ~~Find the midpoint of a line segment.*~~
- ~~Interpret and use information from graphs in the coordinate plane.~~
- ~~Match number line graphs with solution sets of linear inequalities.~~
- ~~Use the distance formula.~~
- ~~Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point.~~
- ~~Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle).†~~
- ~~Match number line graphs with solution sets of simple quadratic inequalities.~~
- ~~Identify characteristics of graphs based on a set of conditions or on a general equation such as y = ax2 + c.~~
- ~~Solve problems integrating multiple algebraic and/or geometric concepts.~~
- ~~Analyze and draw conclusions based on information from graphs in the coordinate plane.~~

~~M6 Properties of Plane Figures~~

- ~~Exhibit some knowledge of the angles associated with parallel lines.~~
- ~~Find the measure of an angle using properties of parallel lines.~~
- ~~Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°).~~
- ~~Use several angle properties to find an unknown angle measure.~~
- ~~Recognize Pythagorean triples.*~~
- ~~Use properties of isosceles triangles.*~~
- ~~Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles.~~
- ~~Use the Pythagorean theorem.~~
- ~~Draw conclusions based on a set of conditions.~~
- ~~Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas.~~
- ~~Use relationships among angles, arcs, and distances in a circle.~~

~~M7 Measurement~~

- ~~Estimate or calculate the length of a line segment based on other lengths given on a geometric figure.~~
- ~~Compute the perimeter of polygons when all side lengths are given.~~

- Compute the area of rectangles when whole number dimensions are given.
- Compute the area and perimeter of triangles and rectangles in simple problems.
- Use geometric formulas when all necessary information is given.
- Compute the area of triangles and rectangles when one or more additional simple steps are required.
- Compute the area and circumference of circles after identifying necessary information.
- Compute the perimeter of simple composite geometric figures with unknown side lengths.*
- Use relationships involving area, perimeter, and volume of geometric figures to compute another measure.
- Use scale factors to determine the magnitude of a size change.
- Compute the area of composite geometric figures when planning or visualization is required.

M8 Functions

- Evaluate quadratic functions, expressed in function notation, at integer values.
- Evaluate polynomial functions, expressed in function notation, at integer values.
- Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths.
- Evaluate composite functions at integer values.
- Apply basic trigonometric ratios to solve right-triangle problems.
- Write an expression for the composite of two simple functions.
- Use trigonometric concepts and basic identities to solve problems.
- Exhibit knowledge of unit circle trigonometry.
- Match graphs of basic trigonometric functions with their equations.

Notes

- Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.
- Standards followed by an asterisk (*) apply to the PLAN and ACT Mathematics Tests only.
- Standards followed by a dagger (†) apply to the ACT Mathematics Test only.

Reading

R1 Main Ideas and Author's Approach

- Recognize a clear intent of an author or narrator in uncomplicated literary narratives.
- Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages.
- Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages.
- Infer the main idea or purpose of straightforward paragraphs in more challenging passages.
- Summarize basic events and ideas in more challenging passages.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages.
- Infer the main idea or purpose of more challenging passages or their paragraphs.
- Summarize events and ideas in virtually any passage.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage.
- Identify clear main ideas or purposes of complex passages or their paragraphs.

R2 Supporting Details

- Locate basic facts (e.g., names, dates, events) clearly stated in a passage.
- Locate simple details at the sentence and paragraph level in uncomplicated passages.
- Recognize a clear function of a part of an uncomplicated passage.

- ~~Locate important details in uncomplicated passages.~~
- ~~Make simple inferences about how details are used in passages.~~
- ~~Locate important details in more challenging passages.~~
- ~~Locate and interpret minor or subtly stated details in uncomplicated passages.~~
- ~~Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages.~~
- ~~Locate and interpret minor or subtly stated details in more challenging passages.~~
- ~~Use details from different sections of some complex informational passages to support a specific point or argument.~~
- ~~Locate and interpret details in complex passages.~~
- ~~Understand the function of a part of a passage when the function is subtle or complex.~~

~~R3 Sequential, Comparative, and Cause–Effect Relationships~~

- ~~Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages.~~
- ~~Recognize clear cause–effect relationships described within a single sentence in a passage.~~
- ~~Identify relationships between main characters in uncomplicated literary narratives.~~
- ~~Recognize clear cause–effect relationships within a single paragraph in uncomplicated literary narratives.~~
- ~~Order simple sequences of events in uncomplicated literary narratives.~~
- ~~Identify clear relationships between people, ideas, and so forth in uncomplicated passages.~~
- ~~Identify clear cause–effect relationships in uncomplicated passages.~~
- ~~Order sequences of events in uncomplicated passages.~~
- ~~Understand relationships between people, ideas, and so forth in uncomplicated passages.~~
- ~~Identify clear relationships between characters, ideas, and so forth in more challenging literary narratives.~~
- ~~Understand implied or subtly stated cause–effect relationships in uncomplicated passages.~~
- ~~Identify clear cause–effect relationships in more challenging passages.~~
- ~~Order sequences of events in more challenging passages.~~
- ~~Understand the dynamics between people, ideas, and so forth in more challenging passages.~~
- ~~Understand implied or subtly stated cause–effect relationships in more challenging passages.~~
- ~~Order sequences of events in complex passages.~~
- ~~Understand the subtleties in relationships between people, ideas, and so forth in virtually any passage.~~
- ~~Understand implied, subtle, or complex cause–effect relationships in virtually any passage.~~

~~R5 Meaning of Words~~

- ~~Understand the implication of a familiar word or phrase and of simple descriptive language.~~
- ~~Use context to understand basic figurative language.~~
- ~~Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages.~~
- ~~Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages.~~
- ~~Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages.~~
- ~~Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts.~~
- ~~Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage.~~

~~R6 Generalizations and Conclusions~~

- ~~Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives.~~
- ~~Draw simple generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.~~

- ~~Draw generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.~~
- ~~Draw simple generalizations and conclusions using details that support the main points of more challenging passages.~~
- ~~Draw subtle generalizations and conclusions about characters, ideas, and so forth in uncomplicated literary narratives.~~
- ~~Draw generalizations and conclusions about people, ideas, and so forth in more challenging passages.~~
- ~~Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so forth.~~
- ~~Draw complex or subtle generalizations and conclusions about people, ideas, and so forth, often by synthesizing information from different portions of the passage.~~
- ~~Understand and generalize about portions of a complex literary narrative.~~

~~Science~~

~~S1 Interpretation of Data~~

- ~~Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables, a food web diagram).~~
- ~~Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels).~~
- ~~Select two or more pieces of data from a simple data presentation.~~
- ~~Understand basic scientific terminology.~~
- ~~Find basic information in a brief body of text.~~
- ~~Determine how the value of one variable changes as the value of another variable changes in a simple data presentation.~~
- ~~Select data from a complex data presentation (e.g., a table or graph with more than three variables, a phase diagram).~~
- ~~Compare or combine data from a simple data presentation (e.g., order or sum data from a table).~~
- ~~Translate information into a table, graph, or diagram.~~
- ~~Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table).~~
- ~~Compare or combine data from a complex data presentation.~~
- ~~Interpolate between data points in a table or graph.~~
- ~~Determine how the value of one variable changes as the value of another variable changes in a complex data presentation.~~
- ~~Identify and/or use a simple (e.g., linear) mathematical relationship between data.~~
- ~~Analyze given information when presented with new, simple information.~~
- ~~Compare or combine data from a simple data presentation with data from a complex data presentation.~~
- ~~Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data.~~
- ~~Extrapolate from data points in a table or graph.~~
- ~~Compare or combine data from two or more complex data presentations.~~
- ~~Analyze given information when presented with new, complex information.~~

~~S2 Scientific Investigation~~

- ~~Understand the methods and tools used in a simple experiment.~~
- ~~Understand the methods and tools used in a moderately complex experiment~~
- ~~Understand a simple experimental design.~~
- ~~Identify a control in an experiment.~~
- ~~Identify similarities and differences between experiments.~~
- ~~Understand the methods and tools used in a complex experiment.~~
- ~~Understand a complex experimental design.~~
- ~~Predict the results of an additional trial or measurement in an experiment.~~
- ~~Determine the experimental conditions that would produce specified results.~~

- ~~Determine the hypothesis for an experiment.~~
- ~~Identify an alternate method for testing a hypothesis.~~
- ~~Understand precision and accuracy issues.~~
- ~~Predict how modifying the design or methods of an experiment will affect results.~~
- ~~Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results.~~

~~S3 Evaluation of Models, Inferences, and Experimental Results~~

- ~~Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model.~~
- ~~Identify key issues or assumptions in a model.~~
- ~~Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.~~
- ~~Determine whether given information supports or contradicts a simple hypothesis or conclusion and why.~~
- ~~Identify strengths and weaknesses in one or more models.~~
- ~~Identify similarities and differences between models.~~
- ~~Determine which model(s) is/are supported or weakened by new information.~~
- ~~Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion.~~
- ~~Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model.~~
- ~~Determine whether new information supports or weakens a model and why.~~
- ~~Use new information to make a prediction based on a model.~~
- ~~Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.~~
- ~~Determine whether given information supports or contradicts a complex hypothesis or conclusion and why.~~

~~Writing~~

~~W1 Expressing Judgments~~

- ~~Show a little understanding of the persuasive purpose of the task but neglect to take or to maintain a position on the issue in the prompt.~~
- ~~Show limited recognition of the complexity of the issue in the prompt.~~
- ~~Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position.~~
- ~~Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position.~~
- ~~Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt.~~
- ~~Show some recognition of the complexity of the issue in the prompt by doing the following:~~
    - ~~Acknowledging counterarguments to the writer's position~~
    - ~~Providing some response to counterarguments to the writer's position~~
- ~~Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion.~~
- ~~Show recognition of the complexity of the issue in the prompt by doing the following:~~
    - ~~Partially evaluating implications and/or complications of the issue, and/or~~
    - ~~Posing and partially responding to counterarguments to the writer's position~~
- ~~Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion.~~
- ~~Show understanding of the complexity of the issue in the prompt by doing the following:~~
    - ~~Examining different perspectives, and/or~~
    - ~~Evaluating implications or complications of the issue, and/or~~
    - ~~Posing and fully discussing counterarguments to the writer's position~~

~~W2 Focusing on the Topic~~

- ~~Maintain a focus on the general topic in the prompt through most of the essay.~~
- ~~Maintain a focus on the general topic in the prompt throughout the essay.~~
- ~~Maintain a focus on the general topic in the prompt throughout the essay, and attempt a focus on the specific issue in the prompt.~~
- ~~Present a thesis that establishes focus on the topic.~~
- ~~Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay.~~
- ~~Present a thesis that establishes a focus on the writer's position on the issue.~~
- ~~Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay.~~
- ~~Present a critical thesis that clearly establishes the focus on the writer's position on the issue.~~

~~W3 Developing a Position~~

- ~~Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas.~~
- ~~Show little or no movement between general and specific ideas and examples.~~
- ~~Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas.~~
- ~~Show little movement between general and specific ideas and examples.~~
- ~~Develop ideas by using some specific reasons, details, and examples.~~
- ~~Show some movement between general and specific ideas and examples.~~
- ~~Develop most ideas fully, using some specific and relevant reasons, details, and examples.~~
- ~~Show clear movement between general and specific ideas and examples.~~
- ~~Develop several ideas fully, using specific and relevant reasons, details, and examples.~~
- ~~Show effective movement between general and specific ideas and examples.~~

~~W4 Organizing Ideas~~

- ~~Provide a discernible organization with some logical grouping of ideas in parts of the essay.~~
- ~~Use a few simple and obvious transitions.~~
- ~~Present a discernible, though minimally developed, introduction and conclusion.~~
- ~~Provide a simple organization with logical grouping of ideas in parts of the essay.~~
- ~~Use some simple and obvious transitional words, though they may at times be inappropriate or misleading.~~
- ~~Present a discernible, though underdeveloped, introduction and conclusion.~~
- ~~Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas.~~
- ~~Use some simple and obvious, but appropriate, transitional words and phrases.~~
- ~~Present a discernible introduction and conclusion with a little development.~~
- ~~Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas.~~
- ~~Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas.~~
- ~~Present a somewhat developed introduction and conclusion.~~
- ~~Provide unity and coherence throughout the essay, often with a logical progression of ideas.~~
- ~~Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas.~~
- ~~Present a well-developed introduction and conclusion.~~

~~W5 Using Language~~

- ~~Show limited control of language by doing the following:~~
  - ~~Correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes significantly impede understanding~~
  - ~~Using simple vocabulary~~
  - ~~Using simple sentence structure~~

- ~~Correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes impede understanding~~
- ~~Using simple but appropriate vocabulary~~
- ~~Using a little sentence variety, though most sentences are simple in structure~~
- ~~Correctly employing many of the conventions of standard English grammar, usage, and mechanics, but with some distracting errors that may occasionally impede understanding~~
- ~~Using appropriate vocabulary~~
- ~~Using some varied kinds of sentence structures to vary pace~~
- ~~Correctly employing most conventions of standard English grammar, usage, and mechanics with a few distracting errors but none that impede understanding~~
- ~~Using some precise and varied vocabulary~~
- ~~Using several kinds of sentence structures to vary pace and to support meaning~~
- ~~Correctly employing most conventions of standard English grammar, usage, and mechanics with just a few, if any, errors~~
- ~~Using precise and varied vocabulary~~
- ~~Using a variety of kinds of sentence structures to vary pace and to support meaning~~

~~Appendix D: National Industry Standards~~

~~The Diesel Service Technician program is written to incorporate the National Automotive Technicians Education Foundation (NATEF) and the Inter-Industry Conference on Auto Collision Repair (I-CAR) learning objectives, content, and hours.~~

~~CRN1 Non-Structural Analysis and Damage Repair~~
~~CRS2 Structural Analysis and Damage Repair~~
~~CRS3 Mechanical and Electrical Components~~
~~CRP4 Painting and Refinishing~~

Appendix E:
National Educational Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

T1 Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

a. apply existing knowledge to generate new ideas, products, or processes.
b. create original works as a means of personal or group expression.
c. use models and simulations to explore complex systems and issues.
d. identify trends and forecast possibilities.

T2 Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.
c. develop cultural understanding and global awareness by engaging with learners of other cultures.
d. contribute to project teams to produce original works or solve problems.

T3 Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students:

a. plan strategies to guide inquiry.
b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
d. process data and report results.

T4 Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:

a. identify and define authentic problems and significant questions for investigation.
b. plan and manage activities to develop a solution or complete a project.
c. collect and analyze data to identify solutions and/or make informed decisions.
d. use multiple processes and diverse perspectives to explore alternative solutions.

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

a. advocate and practice safe, legal, and responsible use of information and technology.

b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. demonstrate personal responsibility for lifelong learning.
d. exhibit leadership for digital citizenship.

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

a. understand and use technology systems.
b. select and use applications effectively and productively.
c. troubleshoot systems and applications.
d. transfer current knowledge to learning of new technologies.